United States Court of Appeals
for the
District of Columbia Circuit

TRANSCRIPT OF RECORD

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United States Court of Appeals for the District of Columbia

OCTOBER TERM, 1938.

386

No. 7291

POWER PATENTS COMPANY, APPELLANT,

vs.

CONWAY P. COE, COMMISSIONER OF PATENTS.

APPEAL FROM THE DISTRICT COURT OF THE UNITED STATES FOR
THE DISTRICT OF COLUMBIA.

FILED NOVEMBER 25, 1938

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United States Court of Appeals for the District of Columbia

A. In the District Court of the United States
For the District of Columbia

In Equity No. 62801.

DOHERTY RESEARCH COMPANY, *Plaintiff*,

vs.,

CONWAY P. COE, COMMISSIONER OF PATENTS, *Defendant*.

UNITED STATES OF AMERICA,
District of Columbia, ss:

BE IT REMEMBERED, that in the District Court of the United States for the District of Columbia, at the City of Washington, in said District, at the times hereinafter mentioned, the following papers were filed and proceedings had, in the above-entitled cause, to wit:

1 *Bill of Complaint*

Filed October 28 1936

In the District Court of the United States for the District of Columbia

In Equity No. 62801

DOHERTY RESEARCH COMPANY, 60 Wall Street, New York, N. Y., *Plaintiff*.

vs.

CONWAY P. COE, Commissioner of Patents, *Defendant*.

The Plaintiff herein for his Bill of Complaint alleges:

I. That the Plaintiff, Doherty Research Company, is a Corporation duly organized and existing under and by virtue of the laws of the State of Delaware, having an office and place of business at 60 Wall Street, in the City, County and State of New York, and brings this suit in its own right;

II. That the Defendant, Conway P. Coe, is the Commissioner of Patents of the United States, a legal resident of the District of Columbia, and is sued as Commissioner of Patents of the United States;

III. That this Bill is filed in accordance with the provisions of the Federal laws of the United States as provided for under the Revised Statutes 4915;

IV. That Henry L. Doherty, Plaintiff's Assignor, filed an application for Letters Patent in the United States Patent Office entitled "Process of Distilling Oil" on February 24th, 1920, Serial No. 361,030; and also filed a divisional application thereof entitled "Process of Distilling Oils" on January 19th, 1929, Serial No. 333,650;

2 V. That the said applications were filed in accordance with the laws of the United States and under the Rules of the Patent Office;

VI. That subsequent to the time of execution of said original application and at the time of the execution of said divisional application, said Henry L. Doherty duly executed and delivered to the Doherty Research Company, assignments of the entire right, title and interest in and to said inventions in "Process of Distilling Oil" and in "Process of Distilling Oils" which assignments contain a request that the Letters Patent to be granted therefor are to issue to said Doherty Research Company, and that the assignment for the original application was executed on March 13th, 1922, and duly recorded in the United States Patent Office on or about March 15th, 1922 in Liber Z 115 Page 341 of Transfers of Patents; and that the assignment for said divisional application was executed on December 28th, 1928 and duly recorded in the United States Patent Office on or about January 19th, 1929 in Liber S 131, page 222 of Transfer of Patents;

VII. That the said applications have been duly prosecuted in accordance with the Laws of the United States and the Rules of the Patent Office;

VIII. That said divisional application Serial No. 333,650, filed January 19th, 1929 has been acted upon by the Primary Examiner who refused to allow the following claims:

1. A continuous process of distilling oil, comprising passing a stream of hydrocarbon oil through a heating zone under a superatmospheric pressure, vaporizing portions of said oil in said zone and heating the resulting vapors,

and unvaporized oil of said stream to a high temperature sufficient to crack a substantial portion of the same, preheating fresh oil and introducing it into an unheated cracking zone in which an enlarged body of liquid oil is retained, introducing said highly heated vapors while at a cracking temperature into direct contact with the body of oil in said cracking zone, whereby the oil of said body is heated
3 to a cracking temperature and portions thereof converted into lower boiling products, subjecting the resulting vapors to reflux condensation and returning portions of the heavier condensate to said heating zone to be further subjected to the cracking conditions maintained herein.

2. A continuous process of distilling and cracking oil for the production of gasoline, comprising passing a mixture of heavy reflux condensate and other oil to be cracked in a stream through a heating zone, vaporizing oil of said stream in said zone and heating the oil constitutents therein to a temperature sufficient to crack the same, passing the highly heated oil constituents from said zone and passing the vapors thereof while hot into an enlarged body of oil in an unheated cracking zone to heat the oil and convert portions thereof into lower boiling products, subjecting the vapors produced in both said zones to reflux condensation to separate higher boiling constituents, and condensing and collecting the desired low boiling products.

3. A process of cracking high boiling oils, comprising continuously passing heavy condensate in a stream through a heating zone, vaporizing oil of said stream in said zone and heating the resulting vapors and any unvaporized oil constituents present therein while passing through said zone to a temperature sufficient to effect cracking thereof, cracking heavy oil in an enlarged liquid body of oil maintained at a cracking temperature in a cracking chamber to which no extraneous heat is applied, passing the vapors from said zone and chamber into a vapor fractionating zone, and condensing out the heavier constituents of said vapors to provide heavy condensate for said heating zone.

4. A continuous process of distilling and converting high boiling hydrocarbon oils, comprising passing fresh charging stock into heat exchange with vapors in a partial condensing zone to preheat said oil and form a condensate

comprising the heavier components of said vapors, passing the charging stock from said zone directly to an externally unheated still in which an enlarged body of oil is maintained at a cracking temperature and from which vapors are conducted to said zone, continuously passing portions of said condensate through a cracking coil where they are heated to a cracking temperature, and then passing the heated products into said still into direct contact with the body of oil therein to supply the entire heat necessary for cracking the oil of said body.

5. The process of converting high boiling hydrocarbon oils into lower boiling gasoline-like products, which comprises continuously passing a stream of the oil through a converter maintained at a sufficient cracking pressure and temperature to convert a portion of the oil in the vapor phase, maintaining an enlarged body of oil under pressure in an unheated still, introducing fresh charging stock into said still, delivering the products from the converter into the body of oil in the still whereby said oil is maintained at a cracking temperature and the oil converted in the liquid phase, separating out the lighter constituents of the evolved
vapors and returning at least a portion of the heavier
4 constituents thereof to the converter for retreatment.

8. The process of converting high boiling hydrocarbon oils into lower boiling gasoline-like products which comprises delivering a heavy oil to an unheated still to supply an initial body of oil thereto, delivering oil including at least in part a suitable distillate continuously to a cracking coil where at least a portion thereof is cracked in the vapor phase at high cracking temperatures and pressures, discharging the evolved vapors into the body of oil in the still to maintain said body at a sufficient cracking temperature and pressure to effect the cracking of the oil in the liquid phase, taking off the evolved vapors, supplying a heavy oil to the still, preheating it by the evolved vapors taken therefrom, separating out the lighter constituents of the evolved vapors and returning at least a portion of the heavier constituents to the cracking coil to replace, in whole or in part, the oil initially supplied thereto.

12. A process of converting oil, comprising passing oil in a continuous stream through a heating zone to vaporize

portions of the oil, heating the vapors and unvaporized oil in said zone to a temperature sufficient to effect cracking thereof, passing the resulting products into an enlarged chamber, maintaining an enlarged body of liquid oil in an unheated cracking zone under cracking conditions of temperature and pressure, preheating fresh charging stock and introducing it into said body, and passing vapor and liquid products from said chamber into said cracking zone in contact with the body of oil therein thereby to maintain the body of liquid oil at a cracking temperature.

13. The process of cracking heavy hydrocarbon oils for the production of gasoline, which comprises maintaining a liquid body of heavy oil in an unheated cracking zone under cracking conditions of temperature and pressure, continuously introducing oil into a heating zone where portions of the oil are vaporized and the resulting vapors and unvaporized oil are heated to a cracking temperature, passing the heated products from said heating zone into an enlarged chamber for further cracking, and passing the vapors from said chamber into the body of oil in said cracking zone to maintain a cracking temperature for the oil therein.

45. A process of converting high boiling hydrocarbon oils into lower boiling gasoline-like products, which comprises continuously delivering oil to be cracked including a suitable high boiling distillate to a highly heated converter in which vaporization and cracking of portions of the oil occurs, continuously delivering a heavy fresh oil charging stock to an unheated still and maintaining an enlarged body of oil therein, delivering the evolved vapors from the oil heated in the converter into the body of oil in the still thereby to heat said oil and maintain the same at a cracking temperature sufficient for liquid phase cracking, removing from the still the evolved vapors of both cracking operations, separating out the lighter constituents thereof and continuously returning at least a portion of the heavier constituents to the converter to supply oil to be cracked therein.

46. A continuous process for cracking heavier hydrocarbons to produce lighter gasoline-like hydrocarbons, which consists in internally heating an externally unheated body of heavy hydrocarbons in liquid phase to

cracking temperature under superatmospheric pressure and distilling portions of the hydrocarbon including the relatively low boiling point cracked hydrocarbons therefrom, introducing fresh charging stock to said body of hydrocarbons, condensing the heavier vapors of the distilled and vaporized hydrocarbons, heating at least a portion of the condensate from the heavier vapors to a cracking temperature while passing in a continuous stream of restricted cross section through a heating zone in which vaporization occurs, injecting the resulting cracked vapors into intimate contact with the hydrocarbons of said body, and separately condensing the lighter vapors removed from said body.

47. The combined process for cracking oils to produce gasoline, which comprises continuously passing a restricted stream of oil containing reflux condensate derived from the process through a heating and cracking zone in which the oil is heated to a temperature sufficient to vaporize portions thereof and to crack a substantial portion of the oil constituents passing therethrough, conducting the resulting hot vapor products from said cracking zone into an enlarged body of oil maintained in a second externally unheated cracking zone, intimately contacting said hot vapor products with the oil of said body whereby portions thereof are cracked to lower boiling point gasoline-like products, introducing charging oil into said second zone, and subjecting the combined vapors produced from the cracking operations to reflux condensation.

48. The combined process of cracking relatively high boiling point oils into oils of lower boiling point for the production of cracked gasoline, which comprises continuously passing a distillate oil in a confined stream of restricted cross section through a heating zone in which the distillate oil is subjected to cracking conditions of temperature and pressure and in which zone portions of said distillate are vaporized, conducting the resulting highly heated vapor products into a second cracking zone to which no outside heat is supplied and in which an enlarged body of oil is maintained under cracking conditions of temperature and pressure, intimately contacting said highly heated vapors with the oil of said body to thereby heat and crack portions thereof, and subjecting the vapors from both cracking zones to fractional condensation to separate the desired low boil-

ing point gasoline constituents from the higher boiling point constituents.

50. A process of distilling oil, comprising passing a stream of hydrocarbon oil through a heating zone under a superatmospheric pressure, vaporizing portions of said oil in said zone and heating the vapors, and unvaporized oil to a high temperature sufficient to crack the same, preheating fresh oil and introducing it into a cracking zone where a body of oil is retained, introducing said highly heated vapors while at a cracking temperature into direct contact with the body of oil in said cracking zone, whereby the oil of said body is heated to a cracking temperature and portions thereof converted into lower boiling products, subjecting the resulting vapors to reflux condensation and
6 returning portions of the heavier condensate to said
heating zone to be further cracked.

51. A process of distilling oil, comprising passing a mixture of heavy reflux condensate and other oil to be cracked in a stream through a heating zone, vaporizing oil of said stream in said zone and heating the resulting vapors to a temperature sufficient to crack the same, passing the vapors while hot into a body of oil in a cracking zone to heat the oil and convert portions thereof into lower boiling products, subjecting the vapors produced in both said zones to reflux condensation to separate higher boiling constituents, and condensing and collecting the desired low boiling products.

52. A process of cracking high boiling oils, comprising passing heavy condensate in a stream through a heating zone, vaporizing oil of said stream in said zone and heating the resulting vapors to a temperature sufficient to effect cracking thereof, cracking heavy oil in a liquid body of oil maintained in a cracking chamber, passing the vapors from said zone and chamber into a vapor fractionating zone, and condensing out the heavier constituents of said vapors to provide heavy condensate for said heating zone.

53. The process of converting high boiling hydrocarbon oils into lower boiling products which comprises passing the oil through a converter maintained at a sufficient cracking pressure and temperature to convert the oil in the vapor phase, maintaining a body of oil under pressure in an unheated still, delivering the products from the converter into the body of oil in the still whereby said oil is maintained at a cracking temperature and the oil converted in the liquid

phase, separating out the lighter constituents of the evolved vapors and returning the heavier constituents thereof to the converter for retreatment.

54. A process of cracking heavier hydrocarbons to produce lighter hydrocarbons which consists in internally heating an externally unheated body of heavy hydrocarbons in liquid-phase to a cracking temperature under pressure and distilling the cracked hydrocarbons therefrom, condensing the heavier vapors of the hydrocarbons and heating the condensate from the heavier vapors to a cracking temperature to vaporize and crack the same, injecting the cracked vapors into said body of hydrocarbons and separately condensing the lighter vapors from said body.

55. The combined process for cracking oils in liquid and vapor phase, which comprises introducing a stream of oil containing reflux condensate derived from the process into a cracking zone in which the oil is heated to a temperature sufficient to vaporize and crack portions thereof in the vapor phase, conducting the hot vapor products from said zone into a body of oil maintained in a second cracking zone, intimately contacting said hot vapor products with the oil of said body whereby portions thereof are cracked in liquid phase, and subjecting the combined vapors produced from the cracking operations to reflux condensation.

7 56. The combined process of cracking relatively high boiling point oils, in liquid and vapor phase into oils of lower boiling point, which comprises subjecting a distillate oil to cracking conditions of temperature and pressure in a zone in which portions of said distillate are cracked in vapor phase, conducting the resulting highly heated vapor products into a second cracking zone in which a body of oil is maintained under cracking conditions of temperature and pressure, intimately contacting said highly heated vapors with the oil of said body to thereby heat and crack portions thereof in liquid phase, and subjecting the vapors from both cracking operations to fractional condensation to separate the desired low boiling point constituents from the higher boiling point constituents.

which he finally rejected in accordance with the Rules of the United States Patent Office;

IX. The Plaintiff in the name of the applicant appealed from the decision of the Primary Examiner to the Board of

Appeals who in part affirmed the rejection of the Primary Examiner in its decisions dated March 13th, 1936 and May 1st, 1936.

X. That the Commissioner of Patents by the Board of Appeals contends that the above claims are unpatentable in said application for certain of the reasons urged by the Examiner. The Examiner contends and the Board of Appeals holds that claims numbered 1 to 5, 8 and 45 to 48 are unpatentable to applicant on the ground of estoppel, by his failure to suggest these specific claims in Interference No. 58,781 (Isom vs. Taveau vs. Brandt vs. Doherty) under the provisions of Rule 109, alleging that the claims read on the Taveau disclosure; although the applicant, the senior party in said Interference, brought a timely Motion to Amend under Rule 109 proposing fourteen (14) claims as counts in the Interference (the other parties to the Interference made no Motion to Amend). That said proposed counts, numbered respectively 2 to 15 inclusive, then corresponded to the claims of said divisional application Serial No. 333,650, numbered respectively 1, 2, 3, 5, 6, 7, 8, 11 and 39 to 44 inclusive, claims numbered 39 to 42 inclusive of which were copied directly from the application of the party Taveau after the declaration of said Interference.

8 That in spite of the dissolution of the said Interference as to the applicant, on the alleged ground that the proposed counts, found patentable were not supported by his disclosure, he has nevertheless, continuously maintained before the Patent Office Tribunals his right to the invention covered thereby and the portion of the claims proposed in said Interference which were held patentable over the prior art by the Patent Office decisions in the Interference. That claims numbered 1, 2, 3, 5, 8, and 45 to 48 inclusive, recited herein, correspond respectively to counts proposed by the applicant in said Interference No. 58,781 and numbered 2, 3, 4, 5, 8, 7, 9, 14 and 15 respectively, with certain amendments made and entered after the dissolution of said Interference for the purpose of improving the form and definiteness of the claims.

The Examiner contends and the Boards of Appeals holds claims numbered 1, 3, 5, 8, 12, 13, 46 and 50 to 56 unwarranted by the application disclosure for the alleged reason that the claims require vapor phase cracking, and that the application does not disclose vapor phase cracking or that the cracking of oil vapors was contemplated or inherently involved in the procedure disclosed. Claims numbered 50 to 56 and included herein are the same as proposed counts 2, 3, 4, 5, 9, 14, and 15, offered by the applicant in his Motion to Amend under Rule 109 in Interference No. 58,781, and correspond respectively to claims 1, 2, 3, 5, 46, 47 and 48 recited herein without the amendments made after the dissolution of said Interference.

XI. That the Plaintiff disagrees with these contentions made by the Examiner and the Board of Appeals, and supported by the Commissioner of Patents, and contends that there is no estoppel in fact by reason of the applicant's failure to offer the specific claims numbered 1 to 5, 8 and 45 to 48 as issues in the Interference referred to by the Examiner and the Board of Appeals. Plaintiff also
9 disagrees with the contentions made by the Examiner
and the Board of Appeals, and supported by the Commissioner of Patents, and contends that the process operations for cracking hydrocarbon oils as defined by claims numbered 1, 3, 5, 8, 12, 13, 46 and 50 to 56 are fully warranted by the application disclosure as will more fully appear by proofs to be submitted. Plaintiff further maintains that the process operations as defined by these claims were contemplated or inherently involved in the procedure disclosed by the application as will more fully appear by proofs to be submitted.

XII. That as plaintiff is informed and believes heretofore and prior to the 24th day of February 1920, the said applicant Henry L. Doherty, then a citizen of the United States and a resident of New York, in the County of New York and State of New York was the first, original and sole inventor of certain new and useful improvements in "Process of Distilling Oil" not known or used by others in this country before his invention thereof, and not patented or described in any printed publication in this country or any foreign country before his invention thereof, or more than two years before his application Serial No. 361,030 for Letters Patent, and not in public use or on sale in this country for more than two years before his said application, and not patented in any country by him or his legal representatives on an application filed more than twelve months prior to said application Serial No. 361,030 for U. S. Patent, and not abandoned;

XIII. That the jurisdiction of this Court depends upon the patent laws of the United States, this being a suit in equity under Section 4915, Revised Statutes (Com. Stats. 9460; U. S. Title 35, Section 63), as amended by act of March 2nd, 1927, to secure an adjudication that Plaintiff is entitled to receive a patent for the invention as specified in the rejected claims herein referred to or for any part thereof, as the facts in the case may appear, and that the defendant be authorized to issue such patent;

Under the provisions of said act of March 2nd, 1927, the said decisions of the Board of Appeals of the Patent Office constitutes a refusal by the Commissioner of Patents to grant a patent on said invention as defined by said claims numbered 1 to 5, 8, 12, 13, 45 to 48 and 50 to 56 inclusive, and no appeal has been taken from the decisions of the Board of Appeals to the Court of Customs and Patent Appeals, and no such appeal is pending or has been decided. Said decisions of the Board of Appeals were delivered on or about March 13th, 1936 and May 1st, 1936, and within the six months following the final decision of May 1, 1936, and notwithstanding the said decisions of the Board of Appeals, the Plaintiff is entitled to receive a patent for the improvement aforesaid constituting the subject-matter of said claims.

WHEREFORE, the Plaintiff prays the Honorable Court:

First, to adjudge and decree that Henry L. Doherty is the true, first, original and sole inventor of the improvement set forth in said claims 1 to 5, 8, 12, 13, 45 to 48 and 50 to 56 inclusive, hereinabove recited.

Second, to adjudge and decree that the Plaintiff is entitled according to law, to receive a patent for the invention specified in and covered by said claims 1 to 5, 8, 12, 13, 45 to 48 and 50 to 56, or for any part thereof as the facts in the case may appear.

Third, to authorize and direct the Commissioner of Patents to issue to Plaintiff Letters Patent of the United States embodying said claims 1 to 5, 8, 12, 13, 45 to 48 and 50 to 56, upon the filing in the United States Patent Office of such adjudication, and upon compliance with the requirements of the law in such cases made and provided.

11 Fourth, that the Plaintiff have a writ of subpena ad respondendum of the United States of America directed to said Conway P. Coe, as Commissioner of Patents, commanding him on a day certain therein to be named to appear and answer to this Bill of Complaint, but not under oath, an answer under oath being expressly waived, and to abide by and perform all and singular such orders and decrees in the premises as to this Court which seem proper and conformable to the principles of equity and good conscience; and that the Plaintiff have such other and further relief as may be just and proper.

And your orator, as in duty bound, will ever pray.

DOHERTY RESEARCH COMPANY, *Plaintiff*

By: ROBERT G GRISWOLD
President

EDMUND G. BORDEN
Counsel for Plaintiff

J. HANSON BOYDEN—
Associate Counsel for Plaintiff

Verification

STATE OF NEW YORK,
County of New York ss.

Robert G. Griswold, being duly sworn, deposes and says, that he is the President of Doherty Research Company, the Corporation named in the within entitled action; that he has read the foregoing Bill of Complaint and knows the contents thereof, and that the same is true to his own knowledge; except as to the matters herein stated to be alleged upon information and belief, and as to those matters he believes it to be true.

ROBERT G GRISWOLD

12 Sworn to before me this 7th day of October, 1936,

BEATRICE TROVILLION
(Seal) *Notary Public, New York County.*

Commission expires Mar. 30, 1938.

Answer to the Bill of Complaint.

Filed November 16 1936

* * *

To the Honorable the Judges of the District Court of the United States for the District of Columbia.

Conway P. Coe, Commissioner of Patents, defendant herein, is absent from the District of Columbia and in his absence, Justin W. Macklin, Acting Commissioner, in answer to the Bill of Complaint alleges on information and belief as follows:

I. He admits the allegations of plaintiff's organization and principal place of business.

II. He admits the allegations of defendant's official position but avers that while defendant has his official residence in the District of Columbia, he is a citizen of and a legal resident of the State of Maryland.

III. He admits that the Bill was filed in accordance with the provisions of Section 4915 R. S. (35 U. S. C. 63.)

IV. He admits the allegation that plaintiff's assignor, Henry L. Doherty, filed an application for a "process of distilling oils", Serial No. 361,030, on February 24, 1920, and filed as a division of said application, on January 19, 1929, application No. 333,650.

V. He admits that the applications were duly filed.

VI. He admits the allegation of assignment by the said Henry L. Doherty to plaintiff.

13 VII. He admits the allegation of due prosecution of the applications.

VIII. He admits that in application No. 333,650 claims numbered 1, 2, 3, 4, 5, 8, 12, 13, 45, 46, 47, 48, 50, 51, 52, 53, 54, 55, and 56, set out in paragraph VIII of the Bill were finally rejected by the primary examiner.

IX. He admits that an appeal was taken from the action of the primary examiner to the Board of Appeals and that that action, in part, was affirmed by the said Board.

X. He admits that the claims were rejected by the examiner and his decision affirmed by the Board of Appeals on the grounds set out in the Examiner's Statement in answer to the appeal and the decision of the Board of Appeals, as alleged in paragraph X of the Bill.

XI. He admits that the plaintiff disagrees with the holdings of the Examiner and the Board of Appeals and contends that the said claims are patentable for the reasons set out in paragraph XI of the Bill.

XII. He admits that in the said applications averments were made corresponding to the allegations of paragraph XII of the Bill, but denies that these allegations are sufficient to justify the issuance of a patent to plaintiff containing the claims set out in paragraph VIII of the Bill since these claims are deemed to be unpatentable for the reasons given by the Examiner in his statement in answer to the appeal and in the decision of the Board of Appeals, copies of which will be furnished at the trial.

XIII. He admits the allegation of jurisdiction. He further admits that he has refused and still refuses to grant plaintiff a patent in view of the rejection by the Examiner of the said claims and the decision of the Board of Appeals with respect thereto, but denies that plaintiff is entitled to receive a patent for the claims specified in
14 paragraph VIII.

He further admits that no appeal was taken to United States Court of Customs and Patent Appeals within six months of the Board of Appeal's decision of May 1, 1936.

WHEREFORE defendant having fully answered the Bill of Complaint denies that plaintiff is entitled to the relief demanded or any part thereof and prays that the Bill be dismissed with all costs of the proceedings against the plaintiff as provided in Section 4915 R. S.

JUSTIN W MACKLIN
Acting Commissioner of Patents.

R. F. WHITEHEAD
Solicitor for the Patent Office,
Attorney for Defendant.

DISTRICT OF COLUMBIA: *ss.*

I, Justin W. Macklin, depose and say that Conway P. Coe, Commissioner of Patents, is absent from the District of Columbia and in his absence I am Acting Commissioner;

that I have read the above answer by me subscribed and know the contents thereof; that the statements of facts therein made as upon personal knowledge are true; and that those made upon information and belief I believe to be true.

JUSTIN W MACKLIN
Acting Commissioner.

Subscribed and sworn to before me this 14th day of November, 1936.

MARY K. CONNOR
(Seal) *Notary Public, D. C.*

My commission expires October 15, 1940.

---

15 *Motion to Substitute Party Plaintiff*

Filed December 24 1937

* * *

Now comes the party Plaintiff, Doherty Research Company, by counsel, and respectfully moves that this Honorable Court authorize that the Power Patents Company be substituted as Plaintiff in the above case.

The following explanation is offered in support of this motion and request. The substitution is deemed desirable because of change of name and assignment, as will be explained. Doherty Research Company amended its charter to change its name to The Propat Development Corporation, a corporation of Delaware. The papers incidental to this change have been recorded in the United States Patent Office in Liber J-170, page 452, as of April 14, 1937. Subsequently, The Propat Development Corporation assigned the invention on which this present cause is predicated and the application for patent relating thereto, which application is identified in the Bill of Complaint as bearing Serial Number 333,650, to Power Patents Company, a corporation of Maine, and the assignment instrument relating thereto has been recorded in the United States Patent Office in Liber J-170, page 467, as of April 14, 1937.

The requested substitution in name will, therefore, not affect the merits of the case and this change is made chiefly to specify in this case the name of the proper assignee to which Letters Patent should be issued.

Respectfully submitted,

J. HANSON BOYDEN—
Attorney for Plaintiff.

16 Washington, D. C.
December 17, 1937.

I consent to the above requested substitution.

R. F. WHITEHEAD
Attorney for Commissioner of Patents.

It is so ordered.

ALFRED A. WHEAT—
Justice.

Memorandum of Court

Filed July 11 1938

* * *

At the hearing the plaintiff withdrew Claims Nos. 5, 8, 50, 54, 55 and 56 limited expressly to "vapor phase cracking"

I do not think that there is anything in the plaintiff's application that would justify a claim to cracking in the pipe still 54 and I agree with the Board of Appeals of the Patent Office in denying Claims Nos. 1, 3, 12, 13, 46, 50, 51 and 52.

I also agree with that Board on the question of estoppel.

The result therefore is that this bill should be dismissed with costs

BAILEY,
J.

Findings of Fact.

Filed October 4 1938

* * *

1. This suit, brought under the provisions of Section 4915 R. S. (U. S. C., title 35, sec. 63), involves an application of Henry L. Doherty for a patent on Process of 17

Distilling Oil, filed January 19, 1929, No. 333,650, assignee to plaintiff Power Patents Company. The said application was filed as a division of a prior application No. 361,030, filed February 24, 1920.

2. The bill of complaint presented for consideration claims 1, 2, 3, 4, 5, 8, 12, 13, 45, 46, 47, 48, 50, 51, 52, 53, 54, 55 and 56 but at the trial claims 5, 8, 53, 54, 55 and 56 were withdrawn.

3. Said application discloses a cyclic process of cracking oils to produce gasoline. The apparatus shown and described includes an externally unheated cracking chamber into which oil is passed after being preheated and to which is also passed vapors and oil from a pipe still. The latter are sufficiently heated to furnish the necessary heat for causing cracking of the oil in the cracking chamber. The uncracked portion of the oil passes from the cracking chamber to a pump by which it is forced through a pipe to a pipe still. It is stated in the specification that the coil of the pipe still is so heated that the point of entrance of the oil is the lowest temperature portion of the coil and the outlet of the coil is the highest temperature portion of the coil, with the result that the oil and vapors passing through the coil are gradually heated to a cracking temperature. There is no statement in the specification that any cracking takes place in the pipe still.

4. Cracking is a process by which a petroleum oil having a high boiling point is coverted into a product having a lower boiling point, such as gasoline.

5. "Vapor phase" cracking is a process in which a vapor or oil is cracked in the absence of liquid oil.

6. Claims 5, 8, 53, 54, 55 and 56, which were withdrawn, are specifically limited to vapor phase cracking.

7. The Doherty application No. 333,650, involved
18 herein, was placed in interference in the Patent Office
with an application of Taveau (now patent No. 1,936,735) and applications of other parties. The Taveau application disclosed an externally unheated cracking chamber in which oil is cracked, the heat necessary to bring about such cracking being supplied by vapors passing into said cracking chamber from a heating coil in which oil is cracked in the vapor phase and the issue of the interference was limited to an apparatus for carrying out such a process.

8. The interference was dissolved as to Doherty on the ground that the count was unpatentable. A motion was filed by Doherty to amend the issue of the interference and this motion was denied as to Doherty on the ground that the proposed claims were not readable on his application because the application does not disclose vapor phase cracking.

9. In the *ex parte* prosecution of the Doherty application after the dissolution of the interference certain of the claims proposed by Doherty in the interference were amended so as to broaden them.

Conclusions of Law.

1. The Doherty application will not support claims which include cracking in the pipe still and claims 1, 3, 12, 13, 46, 50, 51 and 52 were properly rejected in the Patent Office.

2. Doherty is estopped to make any claim which could properly have been brought forward by him in the interference.

3. Doherty is estopped to make claims 1, 2, 3, 4, 45, 46, 47 and 48.

4. Plaintiff is not entitled to a patent on said Doherty application containing the claims presented in the
19 bill of complaint.

5. The bill of complaint should be dismissed.

JENNINGS BAILEY.
Justice.

Final Decree.

Filed October 4 1938

* * *

This cause having come on to be heard and having been tried in open court and argued by counsel for the respective parties upon the pleadings and proofs adduced and submitted to the Court,

It is ADJUDGED, ORDERED and DECREED this 4th day of October, 1938, that the Bill of Complaint in this case be, and the same hereby is dismissed with costs against the plaintiff.

JENNINGS BAILEY
Justice.

Approved As To Form:

J. HANSON BOYDEN—
Attorney for Plaintiff.

From the foregoing decree the plaintiff, Power Patents Company, in open court on the date named above, notes an appeal to the United States Court of Appeals for the District of Columbia, and the Court fixes the cost bond on said appeal in the sum of $100, or in lieu thereof the sum of $50 in cash to be deposited with the Clerk of this Court.

JENNINGS BAILEY
Justice.

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20 *Notice of Appeal*

Filed October 20 1938

* * *

Notice is hereby given this 20 day of October 1938, that Plaintiff, Power Patents Company hereby appeals to the United States Court of Appeals for the District of Columbia from the judgment of this Court entered on the 4th day of October, 1938, in favor of Defendant, Conway P. Coe, Commissioner of Patents against said Power Patents Company

J. HANSON BOYDEN—
Attorney for Power Patents Company

Memorandum

OCTOBER 20-1938.

Bond ($250) on appeal—filed.

Designation of Record

Filed November 9-1938

* * *

Now comes Power Patents Company, Appellants in the above named cause and designates the parts of the record which they desire to have included in the Transcript, said parts being considered sufficient for the determination of the question raised on appeal, namely:

1. Bill of Complaint
2. Answer
3. Motion to substitute party plaintiff and order.
4. Statement of Evidence, and stipulation attached thereto.
5. Copy of Findings of Fact and Conclusions of Law as adopted by the court.
6. Decree and notice of appeal

21 7. The following Plaintiff's exhibits:

(1) Certified copy of file contents of Doherty Application.
(2) Drawing showing a modified form of Figure 1 of the Doherty Application
(3) A chart giving a comparison of claims 47 and 50 of the Doherty Application
(4) A chart comparing claim 1 and claim 50 of the Doherty application
(5) A chart comparing claim 2 and claim 51 of the Doherty application
(6) A copy of Taveau patent No. 1,934,735, the application of which was in interference with the Doherty application
(7) A chart designated "Claims in Suit".

8. Defendant's exhibits:

(1) A folder containing
    (a) Prints of Drawings
    (b) Examiner's Statement
    (c) Decision of the Board of Appeals
    (d) Decision of the Board of Appeals on Request for Reconsideration
    (e) Decision of the Board of Appeals on Request for Ruling on Claim 15, and
    (f) Decision of the Board of Appeals in Interference No. 58,781.

9. This Designation of the Record and stipulation appended thereto.
10. Clerk's Certificate.

By
J. HANSON BOYDEN—
Of Counsel for Plaintiff

Stipulation

It is this 3rd day of November, 1938, hereby stipulated and agreed between the parties hereto, by their respective attorneys, that the transcript on appeal shall comprise those parts of the original proceedings and exhibits
22 as are set forth in the foregoing Designation of the Record, to which this stipulation is appended.

And it is further stipulated that the exhibits including charts, drawings and patents referred to in the Designation of the Record may be printed and/or bound as a part of the record on appeal, to follow the Statement of Evidence.

R. F. WHITEHEAD
Counsel for Defendant.

J. HANSON BOYDEN.
Of Counsel for Plaintiff.

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23 District Court of the United States for the District of Columbia

UNITED STATES OF AMERICA,
District of Columbia, ss:

I, Charles E. Stewart, Clerk of the District Court of the United States for the District of Columbia, hereby certify the foregoing pages numbered from 1 to 22, both inclusive, to be a true and correct transcript of the record, according to directions of counsel herein filed, copy of which is made part of this transcript, in cause No. 62801 in Equity, wherein Doherty Research Company is Plaintiff and Conway P. Coe, Commissioner of Patents, is Defendant, as the same remains upon the files and of record in said Court.

IN TESTIMONY WHEREOF, I hereunto subscribe my name and affix the seal of said Court, at the City of Washington, in said District, this 25th day of November, 1938.

C. E. STEWART,
(Seal) *Clerk.*

24 Endorsed: United States Court of Appeals for the District of Columbia Filed Nov 25 1938 Joseph W. Stewart, Clerk.

Endorsed: Filed Nov 9-1938 Charles E. Stewart, Clerk.

In the District Court of the United States for the District of Columbia

No. 62,801 in Equity

POWER PATENTS COMPANY, *Plaintiff*

vs.

CONWAY P. COE, Commissioner of Patents, *Defendant*

Stipulation

It is hereby stipulated and agreed that the Statement of Evidence as prepared by the Plaintiff and attached hereto, service and receipt of a copy of which is acknowledged by the Defendant, shall constitute the Statement of Evidence for the purpose of this appeal and that the same may be received without further amendment, Defendant hereby consenting to the immediate approval of said Statement of Evidence by the court, and hereby waiving the period allowed under the rules in which to make objection and/or present amendments.

EDMUND G. BORDEN
Of Counsel for Plaintiff

R. F. WHITEHEAD
Of Counsel for Defendant

25 In the District Court of the United States for the District of Columbia

No. 62,801 in Equity.

POWER PATENTS COMPANY, *Plaintiff*

vs.

CONWAY P. COE, Commissioner of Patents, *Defendant*

Statement of Evidence

BE IT REMEMBERED that the above-entitled cause came on for trial on the issues framed by the pleadings on Monday and Tuesday June 13th and 14th, 1938, Mr. Associate Justice Jennings Bailey, presiding.

Appearances:

On Behalf of the Defendant: Robert F. Whitehead, Solicitor for the Commissioner of Patents.

On behalf of the Plaintiff: Edmund G. Borden

Opening Statement on Behalf of Plaintiff

Thereupon by direction of the Court to proceed, counsel for Plaintiff explained the nature of the suit and pointed out the fact that no question of anticipation by prior references was involved in this action for issue of a patent, but that two other questions were raised, i.e.

(1) Whether the claims under rejection contain features that were not disclosed in the Doherty application;

(2) Whether Doherty is estopped to make claims under rejection based on the alleged failure to present the claims by a Motion to Amend under Rule 109 in an interference between the Doherty application and an application of Taveau,* (T. P. 2 and 3).

26 Counsel for Plaintiff then outlined the interference proceeding in which this Doherty application was involved in an interference with an application of Taveau and stated that a Motion to Amend had been filed in the interference which included fourteen claims. After the interference proceedings had been finished the claims were rejected on the ground of lack of disclosure and appeal was taken on seven other claims, some of which were claims that were presented by the Motion to Amend and modified by amendments, (T. P. 4, 5 and 6).

Counsel for Plaintiff also explained to the Court the nature of the oil cracking process disclosed in the Doherty application, and particularly pointed out that in general the steps of the process include the pumping of hot oil preheated to a cracking temperature into a long continuous coil mounted in a pipe still furnace, heating the stream of oil passing through the furnace to a cracking temperature and vaporizing substantial portions of the oil, discharging the resulting highly heated vapors and unvaporized oil products into a separating chamber where vapors separate from liquid oil, passing the liquid oil into a cracking zone containing a body of oil to be cracked, effecting the cracking of the oil of said body by passing the highly heated separated vapors into intimate contact therewith, fractionating the vapors produced in the whole operation to separate a heavy distillate oil not suitable as gasoline, subjecting this heavy distillate to recracking in the process, and finally collecting cracked gasoline from the vapors which remain uncondensed in the fractionating operation, (T. P. 6, 7 and 8).

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* T. P. indicates "Transcript of Proceedings" 2d and 3d pages.

Counsel also explained (T. P. 8) that insofar as concerns the question of the lack of disclosure of features of the claims in the Doherty application that the entire controversy centered around the question of whether there
27 was any cracking of vapor in the tubular cracking
coil or heater.

Counsel for Plaintiff then called the Court's attention to a chart showing the claims in issue, and pointed out with respect to the question of lack of disclosure that claim 47 was not rejected on this ground by the Patent Office Board of Appeals, although it contains steps specifying the vaporization of portions of the oil and the heating of the oil to a temperature sufficient to crack a substantial portion of the oil constituents passing through a heating and cracking zone. Counsel indicated that the evidence to be presented would show that where oil and vapor are raised to a cracking temperature in the pipe still and the oil cracked, as approved by the Board of Appeals in claim 47, the vapors would inherently and necessarily crack. In this connection counsel also explained the nature of cracking and stated that there would be substantially no difference between the molecules in the vapor state and in the liquid state, and that the vapors would be just as susceptible to the cracking temperature condition as would the liquid, (T. P. 9, 10 and 11).

With respect to the question of estoppel, counsel for Plaintiff mentioned the fact that claim 50 was identical with one of the counts offered by Motion to Amend in the Taveau interference, and that it was originally numbered claim 1, which now differs from claim 50 by reason of certain amendments entered after the interference. Counsel stated that these amendments had not changed the subject matter of invention covered. Counsel further pointed out that claims 50, 51 and 52 were offered by Doherty in the Taveau interference, but that Taveau had not adopted and did
28 not make the counts corresponding to claims 50 and
51, and that while he had adopted claim 52, he later cancelled it from his application and thereby abandoned the subject matter, (T. P., 11, 12).

Counsel for Plaintiff further stated that of all of the claims rejected on the ground of estoppel some of the claims were the same as claims that were introduced by the Motion to Amend under Rule 109 in the Doherty-Taveau interference and the other claims cover the same subject matter as claims that were included in the Motion to Amend; that, although the claims may not have the identical terminology, the subject matter or substance of the claims was the same as claims that were included in the Motion to Amend.

Counsel explained that claims 12 and 13 were claims that were originally in the Doherty application. They were not involved in the interference and these claims contain features which could not be made in the Taveau application because they call for the use of a separator for separating oil and vapors that have passed through the heating coil. If Taveau could not make the claims there could be no estoppel. Some claims on appeal have the limitation of passing a mixture of liquid and vapor from the heating coil into an unheated chamber. Taveau did not show this feature and therefore there could be no estoppel with reference to these claims, (T. P. 12).

Counsel for Plaintiff had previously agreed with counsel for Defendant on the definition of vapor phase cracking which was stated to be: cracking in which oil passing through a coil was all vaporized and the cracking taking place in the vapor state in the absence of liquid. In view of this definition claims 5, 8, 53, 54, 55 and 56 involved
29 in the appeal were withdrawn because these claims were considered to be limited to vapor phase cracking, (T. P. 13).

Counsel for Plaintiff then explained that Taveau is claiming only vapor phase cracking and does not have a right to cover claims wherein the cracking is carried on in the mixed condition of vapor and liquid cracking. Also Taveau did not adopt claims 50 and 51 which were suggested in the Motion to Amend and therefore there could be no interference between the Taveau patent and the Doherty patent if the claims now on appeal were granted to Doherty. Claim 52 was adopted in the Taveau application and canceled therefrom. Doherty therefore is not estopped to assert his right to this claim, (T. P. 14, 15 and 16).

Opening Statement on Behalf of Defendant

The solicitor for the Commissioner of Patents (Defendant) thereafter stated that two questions were in issue, that is, the question of the sufficiency of disclosure of the Doherty specification, and the question of estoppel applied against certain of the claims. The solicitor stated that the question of disclosure related only to the steps carried out in the coil of the pipe still 54, shown in the drawings of the Doherty application, and that from reading the specification he failed to find anything to show that any cracking operation of the vapors is intended to take place in the coil 54, (T. P. 17 and 18).

The solicitor for the Commissioner of Patents explained the question of estoppel and the method of its application in interference practice in the Patent Office, and he went on to point out that in the present instance Doherty was not estopped and could not be estopped as to identical claims which he brought forward in the interference, but the solicitor alleged that there would be estoppel if these same claims were amended as was done in certain instances by Doherty, (T. P. 18, 19 and 20).

Counsel for the Plaintiff then called as a witness Mr. William Kaplan.

Testimony of William Kaplan

Mr. Kaplan after having been first duly sworn, and testifying in response to questions by Counsel, stated as follows:

That his name is William Kaplan, and that he resides at Lynbrook, Long Island, New York. He graduated from the Massachusetts Institute of Technology in 1927 and immediately took a position in the Oil Refinery of the Cities Service Refining Company at East Braintree, Massachusetts, and worked for two years on the atmospheric distillation stills, the gasoline treating plant and on the Holmes-Manley cracking units, (T. P. 21). At the end of two years he was transferred to the Doherty Research Company at Petty Island, New Jersey, to take charge of the operation of an experimental Doherty cracking unit and that he conducted research work in connection with the treating of the products from the Doherty cracking units, the operation of which he followed at Petty Island.

In 1929 he investigated the principle of vapor phase cracking units in various parts of the country and conducted considerable test work on the commercial units, (T. P. 22).

That since 1932 he had been employed in New York on designing and research contacting in connection with both commercial and small scale equipment and has
31 operated and observed the operations of various oil cracking units constructed in accordance with the disclosures of certain patents. At the time he gave his testimony he was engaged in the design of experimental and commercial cracking units, and that since 1932 when he went to Petty Island, he had been connected with and had observed the operation of the Doherty cracking units, (T. P. 22).

Kaplan defined cracking broadly as a decomposition in which the oil molecule is not subjected to complete disintegration but is merely broken in one or two places. He stated that in the cracking unit we start with oil molecules which are relatively heavy, such as fuel oil, or gas oil, or kerosene, and we crack these molecules into smaller molecules coming within the gasoline range, and that this cracking is accomplished by heating the oil to the proper temperature, roughly above 700°F., where the hydrocarbon molecules become less and less stable, so that they break or crack. The witness pointed out that the higher the temperature, the more rapid the rate of cracking, the rate doubling for approximately each 20°F. rise in temperature, so that as an example, the rate of gasoline formation at 820°F. would be twice that at 800°F., and similarly the rate at 840°F. would be four times that at 800°F., (T. P. 22 and 23).

The witness further stated that in commercial cracking operations it was usually the aim to heat the hydrocarbon oil to a suitable decomposition temperature to hold the oil at that temperature for a suitable length of time to effect the desired conversion or cracking. He also stated that the cracking operation might be varied by varying the time and temperature relationships in order to secure either a
32 particular yield or a particular type of product. In these operations, the pressure used is important only as it affects the time the oil can be maintained in the particular apparatus, and pointed out that a process can be operated under pressure and retain more of the hydrocarbons in the liquid state, and consequently in a given piece of equipment the time can be increased, (T. P. 23 and 24).

The witness Kaplan stated that he was familiar with the Doherty application before the Court, a certified copy of the file history of which was offered in evidence, and received as, (T. P. 24),

Plaintiff's Exhibit No. 1

The witness then produced a drawing which he stated was the same as Fig. 1 of the drawings of the Doherty application with certain of the surplus reference numerals removed. This drawing was later offered in evidence, and received as, (T. P. 24),

Plaintiff's Exhibit No. 2

The witness Kaplan used the drawing of Exhibit No. 2 in describing the Doherty cracking process disclosed in the Doherty application, before the Court, stating that the oil to be cracked is introduced into the apparatus shown in the drawing through the line 10, and pumped by means of a pump 12, through line 14, to a series of fractional condensers 16, 18, 20, 22, 24, 26, 28, and 30, in which the oil is pre-heated by indirect heat exchange with hot oil vapors passing around tubes in the condensers while the oil passes through the tubes. The preheated oil then passes through a line 34 into the upper part of a cracking chamber 36; this oil being withdrawn from the lower portion of the cracking chamber 36 through a line 46, and passed by
33 means of a pump 50 through line 52 to the heating
and cracking coil 54, (T. P. 25). The oil enters the cracking coil at a cracking temperature, and in flowing through the coil the temperature is raised and part of the oil is vaporized. The heated vapors and oil are mixed and the mixture which is raised to a cracking temperature passes through a line 60 to a separator 62 in which the liquid oil separates from the vapors. The vapors are passed through a line 64 by way of valve 47, into the lower part of the chamber 36, while the separated liquid flows by way of a line 66 into the intermediate part of the cracking chamber 36. Unvaporized oil is withdrawn from the bottom of the separator 62 and cracking chamber 36 to a still 116, where distillation of the oil is caused by pressure reduction, but this distilling operation is not involved in the controversy.

The vapors leaving cracking chamber 36 pass through a fractional condenser 70 and then through the condensers

30, 28, etc., referred to above, the condenser 70 serving to condense the higher boiling hydrocarbons which are returned to the cracking chamber 36. Fractional condensates are also obtained from condensers 30 to 16 while the gasoline produced in the cracking operation passes through a cooler 82, is collected in a trap 83 and is removed from the apparatus, (T. P. 26).

In response to further questions by counsel for Plaintiff,
the witness Kaplan stated that he had read the decisions of
the Board of Appeals relating to the claims before the
Court, and thereupon the solicitor for the Commissioner of
Patents stated that while the Board had discussed
34 the claims one by one in relation to references, the
question of anticipation of the claims by references is
not at issue in the present appeal, (T. P. 27).

The witness continuing, stated that the Board had rejected claims on the ground of lack of disclosure of vapor phase cracking in the Doherty application and on the ground of estoppel. In connection with the question of lack of disclosure, the witness made a comparison between claim 50 and claim 53 (this claim not being before the Court) to explain the way in which the Board of Appeals had arrived at its decision, by reading the portions of these claims relating to the heating step, stating that claim 50 requires that both liquid and vapor pass through the heating zone, whereas claim 53 calls for a vapor phase process; the difference lying in the fact that the material leaving the heating coil is all vapor rather than being a mixture of liquid and vapor, (T. P. 28).

At this point, (T. P. 29), the witness explained that "vapor phase cracking" means the absence of liquid, or that the vapors must be at a cracking temperature long enough to effect the cracking in the absence of liquid; that the Board of Appeals did not clearly set forth what it considered a proper definition of vapor phase cracking, and; that the term "phase" means a homogeneous or uniform state or condition, as for example, we usually considered that a substance may take three different phases, that is, the solid phase, the liquid phase and the vapor or gaseous phase. The witness indicated that he considered the use of the term "mixed phase" as an improper designation of a mixture of liquid and vapor, because it was really inconsistent, since a mixture of liquid and vapor would

35 not be one phase but would rather be what he termed a "mixed condition."

The witness Kaplan then produced a chart, (T. P. 30), which had been used by counsel for the Plaintiff in his opening statement and stated that he prepared the chart and that it shows a classification of the claim before the Court and the ground of rejection by the Patent Office; that the chart also shows the character of the "heating step" for each claim by the letter "M" or "V"; the "M" meaning mixed, that is, mixed condition; and the "V" meaning vapor phase. The witness further stated that some of the claims seem to have terminology broad enough to cover either the mixed condition or include all vapor, and that these had been classified as "M or V".

The witness in referring to the chart stated that claims 1, 3, 5, 8, 12, 13, 46, and 50 to 56 were rejected on the ground of lack of disclosure, and that this specific lack of disclosure related exclusively to what happens in the heating step of the process, (T. P. 31). Claims numbered 5, 8 and 53 to 56 which included the vapor phase cracking, were withdrawn.

The witness Kaplan testified that the Patent Office Examiner had indicated a definition of vapor phase cracking in the first Office Action, Paper No. 3, by rejecting claims 5 to 11 as unwarranted, because the applicant did not disclose vapor phase cracking in the pipe still 54. In this same Office Action claims 1, 2 and 3 were not rejected for lack of disclosure and these claims are identical with claims 50, 51 and 52 then before the Court, (T. P. 32). The witness stated that he did not consider claims 50, 51 and 52
36 limited to vapor phase cracking and that, therefore,
he felt that the Examiner had in mind the same definition of vapor phase cracking previously given by the witness (cracking of vapor in the absence of liquid).

The witness also stated that the decision of the Examiner of Interferences, (T. P. 32), gave a definition of vapor phase cracking which required that of vapor only with no liquid present.

The witness was further questioned regarding the chart showing the classification of the claims before the Court, and stated that claims marked with the letter "M" required a mixed condition or that liquid be present through the entire length of the heating coil, and that since claims

5, 8 and 53 to 56 were no longer in this controversy, none of the *remaining claims require vapor phase cracking of oil;* that after reading the heating step of claim 50 the witness regards it as restricted to a mixed condition and thinks that the language is clear that both vapors and unvaporized oil are heated to a high temperature in passing through the coil.

The witness then stated, (T. P. 34), that in the Board of Appeals decision, claims numbered 2, 4, 45, 47 and 48 were not rejected on the ground of lack of disclosure.

The witness stated that the Board of Appeals in its decision had made certain admissions regarding the heating step carried out in the pipe still 54 of the Doherty application, and quoted the admission as follows, (T. P. 35):

> "(1), liquid oil to be heated is introduced into the coil 54 at its cracking temperature from the chamber 36.
>
> "(2), this liquid oil is raised in temperature in the coil 54.
>
> "(3), this oil is also heated to a cracking temperature in coil 54.
>
> 37 "(4), some of this oil is cracked in coil 54.
>
> "(5), a substantial part of the liquid oil is vaporized in coil 54 (in order to supply vapor at high temperature for heating and cracking the body of oil in chamber 36)."

The witness Kaplan read the following portions of the Doherty specification relating to what takes place in the coil 54 with respect to vaporization and cracking of oil:

"In accordance with this object, another feature of the invention contemplates separating vapors from an oil which has been heated to a cracking temperature," (page 2, starting with line 14).

The witness commented that this statement indicates the heating of a mixture of oil and vapor to the cracking temperature, after which they are passed into a separator for the separation of vapors from liquid oil; or, in other words, that you have the disclosure of heating oil to a cracking temperature and vaporization occurring during this heating, (T. P. 36).

"The oil introduced through the pipe 44 has been previously treated in the cracking operation and has been heated to the most advantageous cracking temperature." (page 4, starting with line 21).

That is, that the oil in the pipe 44 has been heated to a cracking temperature before it enters chamber 36.

"Further, the oil vapors which are formed in the pipe still are absorbed by the gas flowing in parallel current
therewith, and at the time the oil and gas have passed
38 through the coil of the pipe still, they are heated to
a cracking temperature and the gas is saturated with
vapors which are also heated to a cracking temperature." (page 6, starting with line 2).

The witness stated that this quotation further bears out the fact that vaporization occcurs in the coil, and the fact that the vapors themselves are heated to a cracking temperature, (T. P. 36).

"As described above the oil introduced through the pipe 44 together with incoming oil flowing downwardly through the upper portion of the cracking chamber are heated to the cracking temperature and pass in countercurrent path through the gas and vapors which are also heated to a cracking temperature." (page 7, starting with line 8).

The witness stated that this refers to the fact that the gas and vapors in the chamber 36 are at a cracking temperature.

"Since the oil in the settling chamber 112 is heated to the cracking temperature while under high pressure, and so forth," (page 12, line 14).

This statement indicates that oil as it enters the pump prior to circulation through the coil is at a cracking temperature.

"In this way the oil and gas are gradually heated up to the cracking temperature in passing through the pipe
still." (page 17, line 30).

39 The witness stated that this is another reference to
the fact that the oil and gasses are heated to the
cracking temperature.

"Some gases are always formed while cracking oil and this gas together with the vapors formed in the pipe still 54 and separator 62 will always produce active countercurrent circulation of the oils and vapors in the cracking chamber 36," (page 22, starting with line 5).

The witness stated that this further describes vaporization in the coil and reference to the gas which is passed through the coil as an aid to vaporization.

The above quotations from the specification show what is taking place in the coil and are generally similar to the admissions of the Board of Appeals referred to previously, (T. P. 37).

Regarding the cracking of oil and vapor in the cracking coil Kaplan stated:

That oil vapors will necessarily crack if you pass oil through a coil, vaporize a substantial part of the oil, and crack a substantial part of the liquid constituents, (T. P. 38). That the vapors must crack, because basically the only difference between a vapor and a liquid oil is in the relative distance between the individual molecules. In the vapor state the molecules are not in as close proximity as they are in the liquid state. However, the rate of cracking or the rate of reaction for any particular hydrocarbon is a function of temperature solely. That if you heat any hydrocarbon to a cracking temperature and hold it there for a long enough period of time, that hydrocarbon will
40 crack, irrespective of whether it is a liquid composed of molecules arranged in close proximity or whether it is a vapor composed of molecules more widely separated, (T. P. 38). That if you heat a hydrocarbon to the same temperature for the same length of time, it does not make any difference whether the hydrocarbon is in the liquid state or in the vapor state, the amount of cracking in each case will be the same. That in a commercial cracking coil, if you have, say 50% by weight of vapor formed, the amount of cracking of the liquid will be slightly greater than the amount of cracking that would occur in the vapor, but there would not be any big difference, (T. P. 39).

With respect to claim 47 which the Board of Appeals had held fully supported by the Doherty disclosure, the witness testified:

Claim 47 refers to the heating of the oil in the coil and states that heating is "to a temperature sufficient to vaporize portions thereof and to crack a substantial portion of the oil constituents passing therethrough."

That where liquid oil is cracked in a coil operation, vapors formed therein would also be cracked; and that in the process covered by claim 47 there would be cracking of the vapors, and you could not avoid it, (T. P. 39).

The witness testified that from a study of the decision of the Board of Appeals he found that the rejection of the claims by the Board of Appeals was based on an objection to the feature of the claims relating to the heating step that took place in the coil 54. There were no other features or steps in the claims that were objected to by the Board of Appeals.

41 The witness further stated, (T. P. 40), in connection with the mixed condition in the applicant's cracking coil, that if he assumed equal amounts of liquid and vapor, there would be a slightly greater amount of cracking of the liquid than of the vapor, because in the case of an actual operation, there is a slight difference in the composition of the liquid and vapor, the vapor being slightly more difficult to crack, so that you actually obtained a little less cracking of the vapor than you do of the liquid, because of the difference in composition; this to be distinguished from a case involving pure hydrocarbons in which the liquid and vapor is heated to the same temperature. In that case you would get equal amounts of gasoline formed or equal amounts of cracking.

The witness then produced a chart, (T. P. 40), comparing the process steps of claims 47 and 50 which was later offered in evidence and received as —Plaintiff's Exhibit No. 3—

In explaining this chart the witness stated that he had attempted to indicate the various process steps and characteristics of the steps and that for example, he had indicated the type of process and then segregated the heating coil operation so as to indicate the material passed through the heating coil, a statement regarding vaporization in the heating coil, and a statement with reference to the temperature attained in the heating coil, as well as any cracking which occurs in the heating coil.

The chart contained the following main headings:

(1) The material entering the body of oil (in the chamber 36)

(2) A description with respect to the body of oil and the type of contact made by the vapors as well as references to the cracking of the body

42 (3) The Fractional condensation step

(4) Any reference to charging oil introduced into the cracking system, (T. P. 41).

The witness stated that from the chart comparison claims 47 and 50 are directed to the same process and invention, even though claim 50 contains an unimportant limitation with respect to the preheating of the fresh oil.

The witness further stated with respect to claim 50, (T. P. 42 and 43), it was one of the claims presented by Doherty by Motion to Amend in the (Taveau) interference, and that in referring to the terminology used in claims 47 and 50, claim 47 mentions a "heating and cracking zone," whereas claim 50 refers to a "heating zone." The same oil is passed through the coils in both claims, that is, a stream of hydrocarbon oil with heavier condensate, and in accordance with both claims portions of the oil are vaporized. The only difference between the heating steps called for by the claims is that claim 50 states that both the vapors and unvaporized oil are heated to a high temperature in order to crack it; whereas claim 47 states that the oil is heated to a high temperature sufficient to crack a substantial part of the oil passing through the coil, and leaves unsaid any reference to what happens to the vapors. The witness pointed out, however, that if a substantial part of oil were cracked, as called for by claim 47, the vapors would necessarily crack.

The witness stated that the pipe still 54 is referred to in the Doherty specification, as a "heater," an "oil heater," a "furnace," a "pipe still," and as a "heating zone," and that claim 47 which was not rejected by the Board of Appeals on the ground of lack of disclosure refers to the heater as "the heating and cracking zone," (T. P. 44).

Kaplan stated that in a cracking operation where
43 a substantial amount of vapor is formed in the coil,
and there is substantial cracking of the liquid, it would be impossible to control the operation so that you could run without some cracking of the vapor; that in the Doherty process as defined by claim 47, it would be possible to operate with 30% or 60% by weight of vapor; and that since the cracking of the body of oil in the chamber 36 was accomplished by vapors produced in the coil, the process contemplates substantial vaporization of the oil in the coil, (T. P. 44).

In further comparing claims 47 and 50, the witness Kaplan stated that the reason for rejecting claim 50 as unsupported by the disclosure and for *not* rejecting claim 47 on the same ground, seemed to be that claim 50 mentions the cracking of vapor; whereas claim 47 does not, but refers merely to the substantial cracking of the liquid oil, (T. P. 45 and 46).

Plaintiff offered in evidence Exhibit No. 3 which is a chart comparing claims 47 and 50. The witness testified that Exhibit 3 indicated that claim 47 was rejected on the ground of estoppel; whereas claim 50 was not rejected on the ground of estoppel.

The witness Kaplan then produced a chart showing a comparison of claims 1 and 50, and a chart showing a comparison of claims 2 and 51, which were later offered in evidence and received respectively as —Plaintiff's Exhibits No. 4 and No. 5,—(T. P. 48).

The witness in explaining these charts stated that they were similar in form to Exhibit No. 3, and that his comparison of claims 1 and 50 shows that features covered in the claims are substantially alike, except for the definition of what occurs during the heating step of the process. 44 The witness pointed out that claim 50, on which there is no estoppel, specifies the heating of the vaporized and unvaporized oil to a high cracking temperature sufficient to crack the same; whereas in claim 1, limitations had been added but which do not change the general meaning of this step, that is, in claim 1 the word "resulting" was added before the word "vapors," and the words "of said stream," and the additional limitation of cracking "a substantial portion" had been added; that the body of oil referred to in claim 1 was described with certain phrases or words which do not appear in claim 50, but that in general the processes covered by the claims are identical.

The witness in referring to Exhibit 5 and comparing claims 2 and 51, (T. P. 49) noted that the same material is passed through the heating coil; that the same vaporization occurs in both coils; and that the only difference between these two claims is that in claim 51 the vaporized oil is referred to as being heated "to a temperature sufficient to crack the same"; whereas the corresponding step described in claim 2 refers to the materials as being heated to a temperature sufficient to crack them. The witness further stated that claim 2 also had the additional requirement that both the heated oil as well as vapors be introduced into the enlarged body, and that except for claim 2 being a little more specific in the description of this body, the two claims are substantially alike; claim 51 being slightly broader in scope, or sufficiently broad to include the heating in vapor phase, whereas claim 2 is definitely limited to the mixed condition in the heating coil. The witness concluded that claims 2 and 51 cover the same invention, the only difference being the slight difference in scope, so that claim 51 is a little broader than claim 2.

45 The witness Kaplan stated that he finds claims 1 and 50 directed to the same invention, the same subject matter, and does not believe that there is any distinction in scope between these claims.

With respect to the rejection on the basis of estoppel, (T. P. 50), the witness stated that the ground for this rejection related only to the step carried out in the heating coil, and that further, the various steps in the claims rejected on the ground of estoppel, (T. P. 51), were included in the 14 claims that were presented by Motion to Amend under Rule 109 by Doherty.

The witness was asked some questions regarding the claims rejected on the ground of estoppel and the matter of their reading on the Taveau patent; whereupon, at the suggestion of the Court, the Taveau patent No. 1,934,735 was offered in evidence and received as —Plaintiff's Exhibit No. 6—, (T. P. 52).

In answering these questions the witness stated that there are a number of claims rejected on the ground of estoppel which differ from the process disclosed in the Taveau patent, but that the claims that do not read on the Taveau patent are those claims that require the mixed condition in the heating coil, and that they are claims numbered 1, 2, 12, 13, 45, 47, 48, and 50, (T. P. 52).

The witness explained that these claims are not readable upon the Taveau patent disclosure (T. P. 53), because they all require mixed liquid and vapor leaving the heating coil 54, and because some of the claims contain additional features which are not disclosed in the Taveau patent, for example, claim 2 states that the liquid that has re-
46 mained unvaporized, as well as the vapors, enter the
body of oil; that claims 12 and 33 include within their scope the separating chamber; whereas Taveau makes no disclosure of any such piece of equipment; and that in the

case of claim 12 the liquid from the separator is also described as entering the body of oil.

Counsel for the Plaintiff pointed out that in the prosecution of the Taveau application, Taveau had adopted claim 52 and had abandoned it, (T. P. 55), and that under such conditions there can be no estoppel, because the claim was abandoned by an adverse party in the interference.

The witness stated that he found that Taveau retained a claim corresponding to claim 52 after the Doherty-Taveau interference, but that Taveau later cancelled this claim for some unexplained reason.

Cross Examination of William Kaplan

The witness Kaplan in response to cross examination by the solicitor for the Commissioner of Patents stated that the words "vaporizing oil of said stream in said zone" in claim 51 means that the oil in the stream is vaporized; that it could mean either *some or all* of the oil; that if it meant all of the oil you would have vapor phase cracking; that the claim is broad enough to read on vapor phase cracking; and that the same is true with respect to claim 52, that is, that both claims are broad enough to cover a vapor phase system of cracking. Thereupon the solicitor for the Commissioner of Patents called the Court's attention to the fact that Plaintiff had withdrawn all claims for the vapor phase system of cracking, (T. P. 55 and 56).

47 The witness stated that he had read and understood the Doherty application; that he did not remember the occurrence of the exact words "substantial amount of vaporization," and that he did not find any statement that a substantial portion or any of the vapors that are formed are cracked, (T. P. 56).

In answer to further questions by the Solicitor the witness Kaplan stated that cracking is a function of temperature and time; that he could arrange a coil to have oil enter cold and leave the outlet of the coil at a cracking temperature, and not get any measurable cracking; that irrespective of the time for cracking and the design of the coil there is not necessarily any cracking in the coil, merely because the vapors and oil leave the coil at a cracking temperature, that is, it is possible to have a mixture of vapor and oil leaving the coil at a cracking temperature and still not have any measurable cracking, (T. P. 58); that he believed that the Doherty specification says that the vapors and oils are passed through the coil so as to leave at a cracking temperature; and in response to a question as to whether or not the Doherty specification says that the vapors are passed through the coil so quickly that there is no substantial deposit of carbon, the witness stated that he remembered a statement regarding low carbon formation in the coil.

The witness further stated that the temperature at which you can crack high boiling hydrocarbons may not necessarily crack low boiling hydrocarbons in the same time; that in the Doherty application it is possible that as the oil passes through the coil 54 some of the low boiling relatively low molecular weight hydrocarbons may vaporize without cracking if you do not crack any of the liquid; that
48 in order to get the same amount of cracking in the same time a higher temperature will be required to crack the low boiling low molecular weight products than for cracking the original high boiling point oil, (T. P. 59); that it would not be possible to pass those vapors through the Doherty coil without cracking when the liquid oil is cracked, because while the temperature for a given amount of cracking of the vapors may be higher than the temperature required for the same amount of cracking of the liquid, if the time is fixed, then the only difference will be in the relative amounts of cracking of the vapor and the liquid, for example, if you crack the liquid and the vapor is three times as refractory (or difficult to crack) as the liquid, you will only form one third as much gasoline from the vapor as that formed from the liquid.

The witness further stated that if the liquid oil is cracked in the coil 54, some of the cracked products would be vaporized and some would stay in solution in the liquid; that the resulting vapors would be of lower boiling point and lower molecular weight than the original liquid oil and would necessarily be cracked under the same conditions which would cause the liquid to be cracked, that is, if the liquid was cracked the vapors would necessarily crack, and the only difference would be one of degree, because of the difference in composition, the vapors being lower boiling in actual operation than the liquid; and that assuming the time to be fixed, lower boiling low molecular weight hydrocarbons require a higher temperature than higher boiling hydrocarbons, to produce a given amount of cracking, (T. P. 60).

49 *Redirect Examination of William Kaplan*

In response to questions by counsel for Plaintiff, the witness Kaplan on redirect examination stated that when he spoke of the vaporization of part of the cracked products and the other part remaining in solution in the oil in the coil, he had in mind a coil somewhat similar to coil 54 of Doherty, (T. P. 60); that in coil 54 vaporization occurs along with cracking; and that this cracking acts almost the same as gas and tends to promote vaporization. The witness further stated that if you pass oil through the coil and produce cracked vapors by cracking the oil and you heat the oil and vapor to a cracking temperature and hold them in the coil for a time sufficient to crack the oil you would also crack the vapor even though the vapors formed by cracking may be more refractory and may not be cracked so much, (T. P. 61).

Counsel for the Plaintiff called the witness's attention to the Doherty application at page 4, line 24 (26) regarding the temperature at which the oil enters the cracking coil 54, and read the following statement:

> “The mixture of preheated raw oil and the oil admitted through the pipe 44 is then held at a cracking temperature as it flows downwardly to the bottom of the cracking chamber to an outlet pipe 46.”

Counsel stated that since the oil pumped to the heating coil 54 is derived from line 46, the quotation would indicate that the oil entering the heating coil 54 is at a cracking temperature, (T. P. 62). Counsel then asked the witness if the vapor and oil passing through the coil 54 and heated therein to a cracking temperature would have sufficient time to crack, and the witness stated:

> 50 “In any reasonable reproduction of this process if you had a cracking temperature you would be bound to get cracking in passing through the coil.”

Recross Examination of William Kaplan

The witness Kaplan in response to questions by the solicitor for the Commissioner of Patents stated in regard to the

Doherty specification, that there is no statement in the specification in regard to any precautions taken to insure that the oil enters coil 54 at the temperature at which it comes out of the cracking chamber; that there is no statement in the specification regarding how long it takes the oil to go through the coil 54 except that it is heated gradually; that the oil is circulated rapidly through the coil so that no carbon is formed, but no figures are given as to how rapidly or slowly the oil goes through the coil; and that there is no statement regarding the time in the coil, (T. P. 62 and 63).

Redirect Examination of William Kaplan

The witness read the following from page 6, lines 7 to 12 of the Doherty specification by direction of counsel for Plaintiff:

"The oil leaving the cracking chamber to pass to the pipe still is heated to substantially a cracking temperature and therefore only a small amount of heat will have to be supplied in the pipe still to vaporize the oil and to provide for any heat of reaction in cracking the oil," (T. P. 64).

In response to questions by counsel, the witness stated that even if oil is passed rapidly through the coil at
51 a velocity which would prevent the precipitation of
carbon, that would not necessarily mean that there was no cracking in the coil, but that you could pass oil through a coil and secure substantial cracking without having much carbon collect in the coil, that being one of the functions of this type of apparatus, that is, that the greater part of the carbon shall be formed in the unheated chambers; that in his experience he did not know of cracking coils in which the oil was circulated at high velocity, where there was cracking, and in which there was no carbon deposit in the coil, but that he did know of coils that have been operated for over a month with substantial cracking in the coil and the operation being terminated not because of carbon in the coil, but for other reasons, and where, at the shutdown, there would be a thin film of carbon in the coil, (T. P. 64).

Witness excused.

Testimony of David G. Brandt

Direct Examination of David G. Brandt

Thereupon David G. Brandt was called as a witness on behalf of Plaintiff and after having been first duly sworn testified as follows, (T. P. 65):

That his name is David G. Brandt and that he resides at Westfield, New Jersey;

That he graduated in Electrical Engineering from Kansas State College in 1912, for about a year he was with the Denver Gas & Electric Company at Denver, Colorado, and then went to Bartlesville, Oklahoma where he was General Superintendent of the Bartlesville Oil & Gas Company and the Bartlesville Interurban Railway Company;

That in 1917 he went to the General Oil Depart-
52 ment of the Henry L. Doherty Company in New
York for about a year and had charge of their refinery operations;

That in May 1919 he was employed by Mr. Doherty as his personal engineer, starting the development and research organization of the Cities Service Company. In this position he developed a number of Mr. Doherty's inventions as well as worked on current problems and general research work for the organization.

That when Mr. Doherty became ill about 1925 or 1926, his work was entirely taken up by the Cities Service organization and has so continued to the present time, (T. P. 66).

That he is familiar with the Doherty application involved in this case, and that he, by Mr. Doherty's direction, carried on research and development work relating thereto;

That the process disclosed by the Doherty application had been put in commercial use, is now in commercial use, and that a total of 25 units had been built embodying the process of the application; that the first unit built in 1922 had a capacity of between 500 to 600 barrels; and that as time went on the units became larger until the capacity was about 1200 barrels of gasoline per day, (T. P. 66); and

That cracking stills embodying the features of the Doherty invention have been used commercially from the year 1922 to date and are still in use.

In response to further questions, the witness stated with respect to the Doherty application that oil is vaporized in the heating coil, and the witness in support of this, referred to the specification, and read the following from page 6, (T. P. 67):

"Further, the oil vapors which are formed in the pipe still are absorbed by the gas flowing in parallel current therewith and at the time the oil and gas had passed through the coil of the pipe still, they are heated to a cracking temperature and the gas is saturated with vapors which are also heated to a cracking temperature." 53

Witness also testified that if you pass oil through the cracking coil 54, vaporize a portion of the oil, heat the oil and vapor to a cracking temperature so as to crack the oil, you will also crack the vapor, because you will have the same hydrocarbons carried in the vapor stream by partial pressure that you have in the liquid stream, and both those same hydrocarbons will crack at the same rate, regardless of whether they are liquid or whether they are vapor, (T. P. 69).

The witness further stated in this connection that a given hydrocarbon will crack substantially at the same rate in the vapor and liquid states if heated to the same temperature for the same time, (T. P. 69).

The witness further stated, (T. P. 69), "vapor phase" is the state of matter in which it is in the vapor form and that the term "vapor phase cracking" means cracking in a hundred percent vapor stream.

The witness Brandt stated, (T. P. 70), that a substantial amount of oil cannot be cracked in the heating and cracking zone as defined in claim 47 where both oil and vapors are heated to a cracking temperature, without cracking the vapor, and that this is true even though some vapors are formed by cracking oil. The witness explained that there would be cracking of the vapor because the oil fed to the coil 54 is not all virgin stock and has had time element at cracking temperature within the cracking zone, as well as some virgin stock; and that this oil passing through the coil will have the same tendency to crack in the coil that it had in the cracking chamber. The witness further explained that as that oil cracks, and in the process also by introducing a fixed gas, the distillation temperature of the hydrocarbon oil passing through the coil 54 is lowered to a point where a substantial amount of oil will vaporize, and those hydrocarbons which had vaporized will have a molecular weight somewhat similar to the liquid oil that is in the tubes themselves; that the vapor will of necessity have an average lower molecular weight than the oil particles in the liquid form, but the intermediates due to the partial pressure, will have exactly the same constituents in the heavy portion of the vapor as in the oil itself; and that therefore we will have liquid and vapor particles of the same molecular weight in the coil. The witness also stated that the difference in the average molecular weight of the vapors and of the oil (liquid) comes primarily from the low molecular weight of the cracked products which of necessity must be in the vapor stream.

Counsel for Plaintiff thereupon read the following from page 6 of the Doherty application, (T. P. 71):

The oil leaving the cracking chamber to pass to the pipe still is heated to substantially a cracking temperature and therefore only a small amount of heat will have to be supplied in the pipe still to vaporize the oil and to provide for any heat of reaction in cracking the oil.''

and asked the witness if there will be cracking of both the oil and vapor in a coil such as the coil 54, if you introduce oil at cracking temperature to the inlet of the coil 54 and pass that oil through the coil, heating it to a crack-
55 ing temperature and vaporize oil in the coil, and the
witness answered that there will be cracking of both liquid and vapor. The witness stated that the oil entering coil 54 at a cracking temperature and passing through the coil will give sufficient time for cracking because the oil has already been conditioned to a cracking temperature within the cracking chamber prior to being fed to the cracking coil or the pipe still—whatever the term is that is used in the specification.

The witness further stated, (T. P. 72), that he had made studies of the commercial Doherty cracking apparatus embodying the features of the claims before the Court and determined that approximately equal amounts of cracking take place in the heater and in the remainder of the apparatus; and that the vapor is heated to the highest temperature in the pipe still or the outlet of the pipe still.

The witness Brandt further stated in response to a question by Counsel for Plaintiff that he did not know what the Doherty application says about vapor cracking in the separator and cracking chamber, but that it does mention a chemical reaction that may go on in the vapor stage in combination with the oil.

The witness was then asked to show how claims 50, 51 and 52 could be read upon the disclosure of the Doherty application. This testimony is as follows, (T. P. 73, 74, 75 and 76 and 80):

"A. Yes, I would say that 50 is in accordance with the specifications. The specification discloses all of the points in claim 50.

"Q. What points are they? Will you please quote from the claim? "A. (Reading:)

56 "A process of distilling oil, comprising passing a stream of hydrocarbon oil through a heating zone under a superatmospheric pressure, vaporizing portions"—

"By the Court:

"Q. (Interposing) Pardon me just a moment. Where is the heating zone?" "A. The heating zone would be the pipe still 54."

The Court. "Very well."

The Witness (continuing to read): "vaporizing portions of said oil in said zone and heating the vapors, and unvaporized oil to a high temperature sufficient to crack the same,"—

"That is in accordance with page 6, lines 5 to 12, I believe it was, where it said heating mixture of oil and vapors to a cracking temperature. Is that correct?"

By Mr. Borden:

"Q. Yes. "A. (Continuing to read:) "preheating fresh oil and introducing it into a cracking zone," —which is in accordance with the specifications. It is preheated in the partial condensers as the heat absorption medium, and is passed into the cracking zone, where it is retained. (Continuing to read:) "introducing said highly heated vapors while at a cracking temperature into direct contact with the body of oil" —that is, the vapors from the separator chambers into the bottom of the cracking chamber."

By the Court:

57 "Q. Just a minute. Where are those heated vapors? Where do those heated vapors enter?" "A. Do you have a diagram?"

"Q. Yes, I have a diagram." "A. The heated vapors enter through vapor line 64 into the bottom of the cracking chamber."

"Q. You said before the heating zone was 54. The cracking zone is 36; is that it?" "A. The cracking zone is 36."

"The Court. Very well."

"The Witness. It says, "introducing said highly heated vapors while at a cracking temperature into direct contact with the body of oil in said cracking zone."

"That cracking zone is 36. The highly heated vapors come from the vapors which are separated from heater 54 by the separator 62 and injected into 36 through pipe 64. (Continuing to read:) "Whereby the oil of said body is heated to a cracking temperature and portions thereof converted into lower boiling products, subjecting the resulting vapors" —which would be the vapors at the top of that chamber— "to reflux condensation" —which would be apparatus 70— "and returning portions of the heavier condensate to said heating zone to be further cracked."

"I would say that all are covered by the specification.

"Now claim 51:

"A process of distilling oil, comprising passing 58 a mixture of heavy reflux condensate and other oil to be cracked in a stream through a heating zone, vaporizing oil of said stream in said zone and heating the resulting vapors to a temperature sufficient to crack the same."

"That again refers to heater 54, and I can see no reason why that claim is not met, in that it says: "passing a mixture of heavy reflux condensate and other oil to be cracked in a stream through a heating zone."

"Now, then, if you pass the oil through the heating zone it does not necessarily mean that you have converted it all into vapor. Otherwise it would not pass the oil through the heating zone. As I understand the definition of 'oil,' here, it means a liquid product. (Continuing reading:) "vaporizing oil of said stream in said zone and heating the resulting vapors to a temperature sufficient to crack the same.''

''I believe that that is exactly what is done. (Continuing to read:) ''passing the vapors while hot into a body of oil in a cracking zone to heat the oil and convert portions thereof into lower boiling products.''

''That would be to pass the vapors, as we have outlined previously, through pipe 54 into cracking chamber 36, and, ''subjecting the vapors produced in both said zones, 'which would be in pipe still 54 and the cracking chamber, 'to reflux condensation to separate higher boiling constituents, and condensing and collecting the desired low boiling products,' which would be the vapors overhead from the cracking chamber and returning the heavy material or heavy oil.''

59 ''Did you also include 52?''

Direct Examination—Resumed

By Mr. Borden:

''Q. At the time that the court adjourned last night you had not finished answering the question which was before you relating to your explanation as to whether the heating step defined in claim 52 was disclosed in the Doherty Application. Will you please answer that question?'' ''A. Claim 52 reads as follows, on the heating step:

''A process of cracking high boiling oils, comprising passing heavy condensate in a stream through a heating zone, vaporizing oil of said stream in said zone and heating the resulting vapors to a temperature sufficient to effect cracking thereof,''

''Claim 52 in that regard reads the same as claim 51, with the exception that claim 51 has, 'and other oil,' so that the same reasoning will apply to claim 52 as applies to claim 51.''

Counsel for the Plaintiff called the witness's attention to page 6, lines 7 to 10 of the Doherty specification, and asked why the oil was further heated in the coil to vaporize the oil and raise the oil and vapors to a cracking temperature, (T. P. 80), and the witness explained that, although the oil entering the heating coil is at a cracking temperature, that the temperature is low, due to the fact that the

rate of cracking has been reduced in the chamber 36 to a point that it is not commercial to continue cracking therein,
therefore the oil is brought back to the heater and
60 its temperature raised to vaporize the oil and pro-
mote an increased cracking rate. The witness further stated, (T. P. 81), that it is not possible to pass the oil and vapor through the coil where the oil enters at a cracking temperature without cracking both the oil and vapor, and that this is true because the application states that the oil enters the heater at a cracking temperature. The witness then read from page 17 of the specification as follows:

"The pipe still 54 is shown more particularly in Figs. 1 and 3. The still consists of a series of pipes 128 which are connected to form a long continuous coil in which the oil is heated (at the top of the page) * * *. The heat is supplied to the pipe still coil in a direction counter-current to the direction of movement of the oil therein, that is, the highest temperature is developed adjacent the inlet end of the coil. In this way, the oil and gas are gradually heated up to the cracking temperature in passing through the pipe still.", (lines 25 to 31).

At this point, in response to queries by the Court, the witness explained, (T. P. 82), that he did not regard the specification inconsistent because it referred to heating the oil and vapors to a cracking temperature when the specification also stated that the oil is introduced to the coil at a cracking temperature because the oil may be at a cracking temperature but the rate of cracking be very low, while by raising the temperature the rate of reaction would be speeded up.

In response to questions by counsel for Plaintiff, the witness stated, (T. P. 82), that as you raise the temperature
the rate of cracking increases, and that within the
61 commercial range, the rate of cracking doubled for
about each 20° rise in temperature.

The witness further stated that he had personally operated the cracking apparatus which he previously testified was built in accordance with the process and apparatus described in the Doherty application.

Cross Examination of David G. Brandt.

The witness Brandt in response to questions by the solicitor for the Commissioner of Patents stated, (T. P. 83), that he had testified in a suit in this Court entitled "Doherty Research Company vs. Conway P. Coe, Commissioner of Patents, Equity No. 58,872" on the 11th of January, 1937, and that he made the following statement:

"I can heat an oil to a cracking temperature and do substantially no cracking of that oil. It depends on the time element at which I will hold that material at a cracking temperature."

Witness excused.

Direct Examination of William Kaplan, Resumed

William Kaplan was recalled to the witness stand on behalf of the Plaintiff, to correct an answer to a certain question, and after having been previously duly sworn, stated in answer to the following question:

"That is, the temperature at which you can crack the high-boiling hydrocarbons may not necessarily crack the low-boiling hydrocarbons in the same time. Is that right?
that the answer should have been: "That is not correct"
or "That is incorrect" and that he believed the following
context of his testimony indicates that the answer
62 previously given is inconsistent with what follows
after.

Closing arguments were dispensed with and Counsel for the Plaintiff was given until the 21st of June to file a Brief and the Solicitor for the Commissioner of Patents granted privilege for filing a reply Brief.

Whereupon the trial of the case was concluded.

63 Plfs. Ex. 1

390

Department of Commerce
United States Patent Office

To all persons to whom these presents shall come, Greeting:

This is to Certify that the annexed is a true copy from the records of this office of the File Wrapper, Contents and Drawings, in the matter of the Pending Application of

Henry L. Doherty, Filed January 19, 1929, Serial Number 333,650, for Improvement in Process of Distilling Oils.

In Testimony Whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed, at the City of Washington, this twenty seventh day of May, in the year of our Lord one thousand nine hundred and thirty-eight and of the Independence of the United States of America the one hundred and sixty-second.

CONWAY P. COE
Commissioner of Patents.

(Seal)

Attest:
D E WILSON
Chief of Division

65 Endorsed: Jan 28 1929 Division 31
333650

Endorsed: American Consulate Toronto, Canada. American Consulate Service $2 Fee Stamp

Certificate of Official Character

Dominion of Canada:
Province of Ontario:
City of Toronto,
Consulate of the United States of America, ss:

I, the undersigned, Vice Consul of the United States of America, at Toronto, Province of Ontario, Dominion of Canada, duly commissioned and qualified, do hereby certify that Hugh Harvie Donald, whose name is subscribed to the paper hereto annexed, was at the time of subscribing the same a Notary Public in and for the Province of Ontario, Dominion of Canada.

Given under my hand and seal of office at Toronto, Canada, this 17th day of January, 1929.

F A BOHNE
(Seal) *Vice Consul of the United States of America.*

Fee No. 68.

66 Canada, Province of Ontario,
County of York, To Wit:

I, Thomas Vernon Gearing, of the City of Toronto in the County of York in the Province of Ontario. Do Hereby Certify:

1. That I am the Clerk of the County Court of the County of York, and that the said Court is a Court of Record in the Province of Ontario, having by law its proper Seal.

2. That Hugh Harvie Donald whose official Seal and Signature as "H H Donald" appear on the annexed proof of acknowledgement, is and was at the time of taking such proof of acknowledgement, a Notary Public duly appointed in and for the Province of Ontario, residing in the said County of York, that under the laws of Ontario he is entitled to administer oaths and take the proof or acknowl-

edgement of Deeds, Conveyances, etc., to be recorded therein, and that his acts in such capacity are entitled to due credit.

3. That I know the said Hugh Harvie Donald and am acquainted and handwriting, and that his said signature is genuine.

WITNESS my Hand and the Seal of the said County Court of the County of York, at the City of Toronto, in the said County of York, this 16th day of January A. D. 1929

THOS V GEARING
(Seal) *Clerk of the County Court of the County of York.*

67 Dominion of Canada
Province of Ontario To Wit:

In the Matter of an oath administered by Hugh Harvie Donald to Henry L. Doherty, in connection with an application for a petition to be filed in the United States Patent Office, Washington, D. C.

I, Hugh Harvie Donald, of the City of Toronto in the County of York, Solicitor

Do Solemnly Declare, that

1. That my full name is as set out above and that I am a Notary Public for the Province of Ontario, as evidenced by the certificate from the County Court of the County of York attached hereto.

2. That I attended one, Henry L. Doherty at the King Edward Hotel, Toronto, and there took three oaths in connection with a Patent Application being submitted by the said Henry L. Doherty to the United States Patent Office at Washington, D. C.

3. That to the best of my knowledge, information and belief, the said Patent Application was for a certain process in the refining of oils, and I am informed and verily believe that the United States Patent Office refused to accept the said Application until a Consular's Certificate was obtained proving that I have been duly appointed a Notary Public.

4. That the said Patent Application bears my signature and seal as hereinafter shown.

And I make this solemn Declaration conscientiously believing it to be true, and knowing that it is of the same force and effect as if made under oath and by virtue of the Canada Evidence Act.

Declared before me at the City of Toronto in the County of York this 16th day of January A. D., 1929

H. H. DONALD (Seal)

68 Endorsed: $38.00 Rec'd
Jan 19 1929 C. C. U. S. Pat. Office

Petition.

To the Commissioner of Patents:

Your petitioner Henry L. Doherty, a citizen of the United States of America, residing at New York, in the County of New York State of New York whose Post Office address is 60 Wall Street, New York, N. Y., prays that Letters Patent may be granted to him for improvements in "Process of Distilling Oils" as set forth in the annexed specification.

And he hereby appoints Edmund G. Borden, 60 Wall Street, New York City, Registration No. 3870, his attorney, with full power of substitution and revocation, to prosecute this application, to make alterations and amendments therein, to sign the drawings, to receive the Patent, and to transact all business in the Patent Office connected therewith.

HENRY L DOHERTY
(Inventor's Full Name)

Specification.

To All Whom It May Concern:

BE IT KNOWN, That I, Henry L. Doherty, a citizen of the United States of America, residing at New York in the county of New York State of New York have invented certain new and useful improvements in "Process of Distilling Oils" and I do hereby declare the following to be a full, clear and exact description of the invention, such as will enable others skilled in the art to which it appertains, to make and use the same.

69 This invention relates to a process of distilling oil and more particularly to a process of and apparatus for cracking heavy hydrocarbon oils to form lighter hydrocarbon oils therefrom.

This application is a division of pending application Serial No. 361,030, filed February 24, 1920, for "Process of Distilling Oils".

Heretofore the commercial processes for cracking heavy hydrocarbon oils to produce lighter hydrocarbon oils, particularly gasoline, have employed a cylinder still in which the oil is heated in a large body. The inherent nature of the cylinder still presents certain limitations in the process which hold down the character and quantity of gasoline which may be recovered. Among these limitations are the formation of hydrocarbons of higher and lower boiling points than the boiling points of the gasoline desired. Although oil may be cracked through a wide range of temperatures, the most advantageous cracking is obtained in a specific narrow range of temperatures. Experience has shown that at the higher temperatures, the rate of reaction is very rapid with a consequent formation of large amounts of fixed gases and carbon. With lower temperatures, the reaction is slower and consequently the time element is an important factor. Since oil is such a poor conductor of heat, it is not practical to use the lower temperatures when distilling oil in a cylinder still and in fact the outside of the still is subjected to very high temperatures in order to drive the heat into the center of the body of oil. This causes a local overheating and a layer of coke is always formed around the inner surface of the still.

70 One object of the present invention is to provide a process by which oil may be uniformly heated to any desired temperature.

In accordance with this object, one feature of the invention contemplates rapidly circulating the oil through a heater in a comparatively small stream and carrying a stream of vaporizing and agitating inert gas in contact and parallel with the oil while it is being heated.

Another object of the invention is to provide a process of cracking oil by which the oil may be held under the most advantageous temperatures for cracking for an extended period of time to allow the cracking or decomposing reaction to be completely effected.

In accordance with this object, another feature of the invention contemplates separating vapors from an oil which has been heated to a cracking temperature and passing the vapors and oil through a cracking chamber in countercurrent paths. The oil entering the cracking chamber is uniformly heated throughout and is maintained at a comparatively uniform temperature throughout the body by being agitated with the gas and vapors passing through the oil. The agitation of the oil assists the cracking reaction and while the oil is being agitated by the vapors, the vapors are repeatedly brought into the reaction zone so that they can enter the reaction to form specific hydrocarbons in accordance with the temperature and pressure conditions in the cracking chamber. In this way the more desirable lower cracking temperatures may be maintained for cracking and the oil may be held for any desired period of time under the proper cracking conditions.

Accordingly, another object of the invention is to provide a process of cracking oils by which the cracking reaction may be effectively promoted at the lower temperatures.

71 A further object of the invention is to provide a process by which the reflux condensation of the higher boiling point vapors may be accurately controlled to bring back into the reaction zone products of any particular range of boiling points.

A further object of the invention is to provide an apparatus by which a hydrocarbon oil may be rapidly and effectively cracked.

With these and other objects in view, the invention consists in the improved process and apparatus of cracking oil hereinafter described and claimed.

The various features of the invention are illustrated in the accompanying drawings, in which:

Fig. 1 is a view in side elevation, partly in section, showing a cracking still embodying the preferred form of the invention;

Fig. 2 is a top plan view of the cracking still shown in Fig. 1;

Fig. 3 is a vertical sectional view of the oil heater and furnace therefor taken on the line 3-3 of Fig. 1;

Fig. 4 is a vertical sectional view of the reflux condenser which is mounted on the top of the cracking chamber; and

Fig. 5 is a vertical sectional view of one of the surface condensers used for condensing the oil vapors removed from the cracking chamber.

The process of the present invention provides a treatment of heavy or high boiling hydrocarbon oils to produce light or low boiling point oils. The raw material for treatment may be kerosene, gas oil, fuel oil, or a mixture of
two or more of these, and the treatment always pro-
72 duces lower boiling point hydrocarbons therefrom.
Under the present commercial conditions the treatment is conducted to produce gasoline. In carrying out the process in the apparatus shown in the drawings, the raw oil from storage is drawn in through a pipe 10 to a pump 12 and carried by means of a pipe 14 into the first condenser 16 of a series of surface condensers 16, 18, 20, 22, 24, 26, 28 and 30 (Fig. 2). It then advances through the condensers while being passed in heat-transferring relationship with oil vapors, which are formed in the cracking operation and flow through the surface condensers countercurrent to the flow of oil. The oil is preheated by the vapors at 300-450°F., depending upon the temperature of the vapors, and flows from the condenser 30 through a pipe 34 (Fig. 2), and enters the upper portion of a cracking chamber 36. In the cracking chamber, the oil is formed into a series of bodies which are separated by trays or horizontal partitions 38 and the oil overflows by gravity from one tray to the next tray below through overflow pipes 40. When the oil has flowed downwardly in the cracking chamber to a tray 42 (Fig. 1), it meets a body of oil which is introduced through a pipe 44. The oil introduced through the pipe 44 has been previously treated in the cracking operation and has been heated to the most advantageous cracking temperature. By the time the incoming raw oil reaches the tray 42, its temperature is raised to substantially the cracking temperature by the hot vapors and gas passing therethrough. The mixture of preheated raw oil and the heated oil admitted through the pipe 44 is then held at a cracking temperature as it flows downwardly

to the bottom of the cracking chamber to an outlet
73 pipe 46.

The incoming raw oil and the mixture of raw oil and cracked oil which flow downwardly through the cracking chamber are constantly agitated by means of gas and oil vapors which are admitted to the bottom of the still through a pipe 48. To accomplish this, the plates 38 which form the bottom of the trays are preferably provided with perforations which have such a size that the gas is permitted to pass upwardly therethrough while the oil is prevented from passing downwardly therethrough. In this way, the gas and vapors entering through the pipe 48 pass upwardly through the bodies of oil on the trays to actively agitate the oils and to transfer to the oil any superheat which they may possess. Further, the oil vapors leaving one tray encounter the oil on the tray above and there is always an intermingling of oil and vapor and an interchange of heat between the vapors and oil. This causes a continual change of state from liquid to the higher boiling point vapors and vice versa, which is inducive of cracking and increases the percentage of low boiling point products in the vapors leaving the cracking chamber.

A portion of the raw oil entering the body of oil in the cracking chamber is cracked in its passage through the cracking chamber from the tray 42 to the bottom of the cracking chamber. The uncracked portion of the oil, together with any uncracked oil which remains from the oil introduced through the pipe 44, after it passes downwardly through the cracking chamber, flow out through the pipe 46 to a pump 50 which forces it through a pipe 52 to a pipe still 54. As the oil flows through the pipe 52, a gas is introduced into the oil through a pipe 56 by means of a pump 58. The gas flows in contact and in parallel current
with the oil and serves to actively agitate and ac-
74 celerate the velocity of the oil passing through the
pipe still 54. Further, the oil vapors which are formed in the pipe still are absorbed by the gas flowing in parallel current therewith and at the time the oil and gas have passed through the coil of the pipe still, they are heated to a cracking temperature and the gas is saturated with vapors which are also heated to a cracking temperature. The oil leaving the cracking chamber to pass to the pipe still is heated to substantially a cracking temperature

and therefore only a small amount of heat will have to be supplied in the pipe still to vaporize the oil and to provide for any heat of reaction in cracking the oil.

75 The mixture of gas, oil and vapors leaving the pipe still flows through a pipe 60 into a separator 62 where the oil is separated from the gas and vapors, and the gas and vapors then flow through a pipe 64 to the pipe 48 positioned at the bottom of the cracking chamber. The oil collected in the separator 62 flows out through a pipe 66 to a float valve 68 and then passes into the pipe 44 connected with the upper portion of the cracking chamber. As described above, the oil introduced through the pipe 44 together with incoming oil flowing downwardly through the upper portion of the cracking chamber are heated to the cracking temperature and pass in a countercurrent path through the gas and vapors which are also heated to a cracking temperature. By the countercurrent movement of the oil and vapors, the oil bodies in the cracking chamber are maintained at substantially a uniform temperature, which temperature can be accurately controlled to be the most desirable temperature for cracking oil in order to give a maximum yield of gasoline. The heated gas passing upwardly through the oil, along with the vapors, acts as an absorbent for the gasoline vapors and helps to sweep them out of the reaction zone and carry them out of the cracking chamber.

As the gas and vapors pass upwardly from the tray 42 through the incoming oil, a certain portion of the higher boiling constituents is condensed in the oil and returned to the cracking zone. The sensible heat of these gases and vapors and the heat of vaporization of the vapors condensed serve to preheat the raw incoming oil to a cracking temperature. These vapors leaving the uppermost tray of the cracking chamber pass through a reflux condenser 70 mounted on and communicating with the upper portion of
the cracking chamber. The temperature of the re-
76 flux condenser 70 is regulated by means of water
which is introduced through a pipe 72. The introduction of water is controlled by a thermostatic valve 74 which in turn is controlled by a thermostat 76 (Fig. 4) mounted in the upper portion of the condenser. With the thermostatic control, vapors of any desired boiling point

may be condensed and carried back into the cracking chamber so as to permit only vapors having a predetermined temperature to pass into the condensers 30-16.

77 The gas and vapors leaving the reflux condenser pass through a pipe 78 and enter the last surface condenser 30. These gases and vapors then pass in series through the condensers 30-16 and finally flow out through a pipe 80 (Figs. 1 and 2) to a water-cooled condenser 82 where the lowest boiling point hydrocarbons are condensed. The fixed gases formed in the process, together with the gases introduced into the circuit through the pipe 56, flow from the condenser through a trap 83 to a pipe 84 by which they are introduced into the lower portion of an oil scrubber 86. In the scrubber 86 the gases are treated with a mineral oil to remove the uncondensed vapors and the gases leaving the upper portion of the scrubber 86 flow through a pipe 88 to the pump 58. Any excess of gas over that necessary in the process may be removed through the pipe 90. If desired, gas from an external source for starting the process or for any other purpose, may be introduced through the pipe 90.

78 As the mixture of gas and vapors advances through the condensers 30-16, it is gradually cooled by the incoming raw oil advancing through the condensers 16-30. The gradual interchange of heat between the incoming oil and the gas and vapors permits the condensation of fractions with sharply defined boiling points, which may vary only by a few degrees of temperature. This idensified fractionation of vapors permits the recovery of a number of products of substantially the desired boiling points and thus avoids the necessity of several redistillations in recovering the marketable products. The fractions condensed in the condensers 30-16 are removed through outlet pipes 92 (Fig. 1) to look-boxes 94 and flow into traps 96 from which they are conducted through pipes 98 to their respective cooling coils 100. The coils 100 are supported in a water-cooling tank 102 and each coil has a connection 104 by which the condensates may be conducted to their respective collecting tanks. If desired, any or all of the condensates passing through the traps 96 may be returned to the cracking chamber by closing valves 106 in the pipes 98 and opening valves 108 in a run-back line 109,

which connects with the raw oil inlet pipe 34. With the apparatus outlined above, the process may be so conducted that all of the heavy fractions of the oil may be held back by the reflux condenser and the incoming oil in the upper portion of the cracking chamber and only the vapors of the desired oil fractions to be recovered are allowed to pass through the surface condensers 30-16. Also, some of the surface condensers may be used in conjunction with the reflux condenser in carrying back any desired fraction to the cracking chamber. Further, if any of the fractions in the surface condensers do not meet the desired speci-
79 fications, they may be returned to the cracking
chamber through the run-back line 109 for retreatment. To promote the positive circulation of the vapors and gas in the condensers and to maintain the proper pressure conditions throughout the apparatus, a pressure-equalizing pipe 110 (Fig. 1) is connected between the vapor-pipe 78 and the oil-inlet pipe 34.

80 In all cracking processes a certain amount of carbon and tarry sludge is always formed and if this material is not removed from the still or oil circuit, it will soon interfere with the cracking operation. Due to the high velocity with which the oil and gas go through the coil of the pipe still 54, the carbon deposited therein is reduced to a minimum. The principal portion of the carbon and tar is set free in the separator 62. The carbon and tar set free in the separator 62 pass down with the oil through a tube 111 (Fig. 1) to a settling chamber 112 where the oil slowly rises to the top and the carbon and tar settle to the bottom. This carbon and tar is intermittently drawn off from the chamber 112 through a pipe 113 and passes through a valve 114 to a still 116. Since the oil in the settling chamber 112 is heated to a cracking temperature while under a high pressure, it contains a large amount of potential energy or sufficient sensible heat to vaporize approximately 50% of the oil when it is reduced to atmospheric pressure. Accordingly, the still 116 is maintained at atmospheric pressure and the carbon and tarry sludge is intermittently drawn off from the settling chamber 112 by opening up the valve 114. The still 116 is not heated but the sensible heat in the sludge will vaporize the lighter constituents at atmospheric pressure and these vapors will

pass out of the still through a pipe 118 to a condenser 120. The vapors collected in the condenser 120 may then be added through the line 121 to the raw oil entering the pump 12 for retreatment in the cracking still.

81 Since the cracking operation is completed in the cracking chamber 36, considerable carbon and tar sludge will be formed therein. To remove this carbon and tar from the oil circuit, the lower end of the cracking chamber is provided with a conical collecting chamber 122 (Fig. 1), which is connected through a valve 124 and pipe 126 with the still 116. The oil containing carbon and tar may be drawn from the cracking chamber 36 in the same manner that it is withdrawn from the collecting chamber 112 and passed into the still 116 to recover any light oil vapors therefrom. The heavy tar sludge which does not vaporize in the still 116 is withdrawn through an outlet 127. Although the distillation operation is continuous, it is preferred to operate the valves 114 and 124 for withdrawing sludge from the oil circuit alternately and intermittently since an intermittent pulsating operation tends to clear the heavy sludge from the pipes 113 and 126 due to the rapid rush of the high pressure oil into the low pressure still 116.

Of the high boiling point vapors which are formed in an oil cracking operation, those vapors which condense at temperatures above 400 to 450°F. carry a large amount of carbon and tarry material. If these vapors are condensed in contact with cooling surfaces, this tarry material is deposited and clogs the condensers as well as seriously interfering with the heat transfer of the condenser. With a cracking chamber constructed as described above, this difficulty is overcome since the vapors are cooled to the desired minimum temperature for removing carbon and tarry material by passing them through the incoming oil in the upper portion of the cracking chamber before the
82 heavy vapors come into contact with the cooling surface of the reflux condenser. When the heavy vapors are condensed within the oil, the carbon and tarry material is caught in the oil and carried downwardly to the collecting chamber at the bottom of the cracking chamber.

83 The cracking chamber 36 described above may consist of any approved form of apparatus in which the

oil may be supported in a body to permit the gas to pass countercurrent therethrough. The function of the cracking chamber is to provide a means by which the oil may be held at a cracking temperature for an extended period of time to permit the cracking and conversion reaction to take place. By means of the apparatus shown in the drawings, the oil is supported in comparatively thin bodies and the gas and vapors passing through the oil act to thoroughly agitate the oil so as to maintain a uniform temperature and to repeatedly bring the vapors into contact with the heated oil to assist in the heat reactions.

To effect the countercurrent treatment of the oil and vapors in the cracking chamber with the apparatus illustrated in the drawings, it is necessary to maintain a lower pressure in the cracking chamber from that in the separator in order that the oil may flow in a continuous circuit throughout the still. The oil entering the separator 62 preferably has a pressure of from 80 to 125 pounds per square inch and this pressure is reduced from 10 to 15 pounds in the cracking chamber. The amount by which the pressure is reduced, however, depends upon the difference in vertical head between the pipes 44 and 48 and is controlled to allow the oil to be admitted into the upper portion of the cracking chamber while the gas is being introduced at the bottom of the chamber. A ten to fifteen pound pressure differential will ordinarily produce an active circulation of the gases and vapors up through the body of the oil in the cracking chamber. To obtain this pressure differential, the oil flows through a float valve and is introduced into the
cracking chamber under the pressure prevailing in
84 the separator with only frictional losses. While the
pressure of the gas and vapors is reduced by means
of a valve 47 in the pipe 48 (Fig. 1), the float valve 68 acts merely to maintain a predetermined level in the separator and only causes slight frictional losses in the pressure of the oil passing therethrough.

85 The pipe still 54 is shown more particularly in Figs. 1 and 3. The still consists of a series of pipes 128 which are connected to form a long continuous coil in which the oil is heated. The pipes are mounted in a horizontal position in a heating chamber 130 of a furnace 132 and the opposite ends of the pipe project through side walls

134 of the furnace. The ends of the pipes 128 are connected by means of return bends 136 (Fig. 3), which are located on the outside of the walls 134 to permit the return bends to be readily removed for cleaning and repairing the pipes. The ordinary tube cleaner which is used for cleaning water tube boilers may be effectively used for cleaning the tubes 128. A division wall 137 (Fig. 3) is placed in the heating chamber 130 to support the central portion of the pipes 128 and prevent them from sagging while being heated. The pipe still is preferably heated by means of an oil or gaseous fuel, which is ignited in a combustion chamber 138 positioned outside of the heating chamber 130. The fuel is introduced into the combustion chamber 138 by means of a burner 140 and the products of combustion are deflected around an ignition arch 142 (Fig. 1) in passing to the upper portion of the heating chamber 130 through a flue 144. The products of combustion pass downwardly through the heating chamber 130 around the pipes 128 to a flue 146 and flow out to the atmosphere through a stack 148. By this arrangement, the heat is supplied to the pipe still coil in a direction countercurrent to the direction of movement of the oil therein, that is, the highest temperature is developed adjacent the outlet end of the heating coil and the lowest temperature developed adjacent the inlet end of the coil. In this way, the oil and gas are gradually heated up to the cracking temperature in passing through the pipe still.

86 The reflux condenser 70 is shown more particularly in Figs. 1 and 4. This reflux condenser is in the form of a steam boiler and converts all of the heat liberated by the condensing vapors into useful steam energy which may be used to drive the pumps or other apparatus. The temperature of the reflux condenser is controlled by varying the steam pressure to produce the products desired and variations in the operating temperatures are regulated by means of the water which is introduced through the pipe 72. The condenser consists of a cylindrical shell 150, the lower end of which is mounted on the upper end of the cracking chamber and the upper end of which is closed by a vapor-collecting dome 152. Tube sheets 154 and 156 are mounted respectively near the upper and lower ends of the shell 150 and a series of long vapor tubes 158 are con-

nected between the tube sheets. The vapors and gas passing out of the cracking chamber flow through the tubes 158 and are cooled by means of water and steam which is positioned around the tubes. By means of the thermostatic control of the water entering the condenser through the pipe 72, the vapors passing up through the dome 152 may be maintained at any desired temperature. To accomplish this, the steam formed from the water in the condenser by the heated vapors, is permitted to flow out of the condenser through a pipe 160 to maintain a uniform pressure within the condenser. The transfer of heat in the lower portion of the condenser from the vapors to water is very rapid as compared to the transfer of heat from the vapors to superheated steam in the upper portion of the condenser. If the temperature of the vapors passing the thermostat 76 tends to rise, the thermostatic valve will be opened to permit more water to flow into the condenser and this influx
of water will continue until the vapors are sufficiently
87 cooled by rapid heat transfer to the water to close
or partly close the valve 74. On the contrary, if the vapors fall below the desired temperature, the valve 74 will be closed to stop the influx of water into the condenser, and the longer path of travel of the vapors in contact with steam with the consequent low rate of heat transfer will allow the vapor temperature to be raised to the desired point before the valve will be opened. With this construction, the water level in the condenser 70 will automatically vary to maintain the desired temperature of vapors flowing out of the condenser through the pipe 78. In case there is a very large volume of vapors having a specific boiling point such that it would overtax the cooling capacity of the condenser 70, these vapors may be partially condensed in the surface condensers 30-16 and returned to the cracking chamber without interfering with the collection of the desired end product in the surface condensers. The reflux condenser 70, however, permits of a wide range of operation, and can be used with a comparatively shall number of fractional
condensers to recover any desired end product.

88 The details of construction of the surface conden-
sers 30-16 are shown more particularly in Fig. 5. These condensers consist of cylindrical drums 162 which have tube sheets 164 and 166 mounted at their opposite

ends. Tubes 168 are connected between the sheets 164 and 166 and the oil is caused to pass through the tubes in effecting a heat interchange with the vapors and gas. Oil-collecting chambers 169 and 170 are formed respectively between the ends of the cylinders 162 and the tube sheets 164 and 166. The chambers 169 and 170 of adjacent condensers are connected by pipes 171 which are arranged to connect the condensers in series so that the oil flows therethrough in a continuous stream. The vapors are introduced into and leave the vapor chambers of the cylinders 162 through pipes 172, the pipes 172 being arranged to connect the ends of the vapor chambers for series circulation. In passing through the vapor chamber, the vapors flow around baffles 174 which effect a uniform distribution of the heat into the oil passing through the tubes 168. Any vapors which are condensed in the shell 162 and on the tubes and baffles are collected at the bottom of the shell 162 and withdrawn through the pipes 92 (Figs. 1 and 5).

With the apparatus outlined above, it will be seen that practically any desired combination of pressure and temperature may be maintained in the pipe still 54, separator 62, and cracking chamber 36. Temperatures of from 600-900°F. and pressures of from 60 to 125 pounds per square inch are the usual working temperatures and pressures which are employed in accordance with the end products desired. The form of pipe still shown in the drawings affords a means by which a large amount of heat may be rapidly placed in the oil and the separator and cracking chamber give a means by which a large body of
89
oil may be maintained at a uniform temperature during the cracking operation. The separator and cracking chamber may be insulated as illustrated at 200 to prevent radiation losses and these parts may be heated in the usual manner by means of exhaust flue gases.

90 While it is preferred to introduce gas under pressure into the oil entering the pipe still, to furnish a carrying medium for the oil vapors and to induce a positive, rapid, circulation of the oil and vapors, this addition of gas is not essential. Some gases are always formed while cracking oil, and this gas, together with the vapors formed in the pipe still 54 and separator 62, will always produce an active countercurrent circulation of the oil and vapors in the cracking chamber 36.

In the process outlined above, the gas introdued is still-head gas which is hydrocarbon that may enter into and assist in chemical reaction or cracking in the still. For many purposes, natural gas is preferred to still-head gas because it contains more of the heavy hydrocarbons that may be useful in the formation of gasoline. Also, inert gases such as flue gas, air, etc. may be used as an agitating and vapor-carrying medium, but it is preferred to use a hydrocarbon gas.

91 Having thus described the preferred form of the invention, what is claimed as new is:

1. A process of distilling oil, comprising passing a stream of hydrocarbon oil through a heating zone under a super-atmospheric pressure, vaporizing portions of said oil in said zone and heating the vapors, and unvaporized oil to a high temperature sufficient to crack the same, preheating fresh oil and introducing it into a cracking zone where a body of oil is retained, introducing said highly heated vapors while at a cracking temperature into direct contact with the body of oil in said cracking zone, whereby the oil of said body is heated to a cracking temperature and portions thereof converted into lower boiling products, subjecting the resulting vapors to reflux condensation and returning portions of the heavier condensate to said heating zone to be further cracked.

2. A process of distilling oil, comprising passing a mixture of heavy reflux condensate and other oil to be cracked in a stream through a heating zone, vaporizing oil of said stream in said zone and heating the resulting vapors to a temperature sufficient to crack the same, passing the vapors while hot into a body of oil in a cracking zone to heat the oil and convert portions thereof into lower boiling products, subjecting the vapors produced in both said zones to reflux condensation to separate higher boiling constituents, and condensing and collecting the desired low boiling products.

92 3. A process of cracking high boiling oils, comprising passing heavy condensate in a stream through a heating zone, vaporizing oil of said stream in said zone and heating the resulting vapors to a temperature sufficient to effect cracking thereof, cracking heavy oil in a liquid body of oil maintained in a cracking chamber, passing the vapors from said zone and chamber into a

vapor fractionating zone, and condensing out the heavier constituents of said vapors to provide heavy condensate for said heating zone.

4. A process of distilling and converting high boiling hydrocarbon oils, comprising passing fresh charging stock into heat exchange with vapors in a partial condensing zone to preheat said oil and form a condensate comprising the heavier conponents of said vapors, passing the charging stock from said zone directly to a still in which a body of oil is maintained at a cracking temperature and from which vapors are conducted to said zone, passing portions of said condensate through a cracking coil where it is heated to a cracking temperature, and then passing the heated products into said still.

5. The process of converting high boiling hydrocarbon oils into lower boiling products which comprises passing the oil through a converter maintained at a sufficient cracking pressure and temperature to convert the oil in the vapor phase, maintaining a body of oil under pressure in an unheated still, delivering the products from the converter into the body of oil in the still whereby said oil is maintained at a cracking temperature and the oil converted in the liquid phase, separating out the lighter constituents of the evolved vapors and returning the heavier constituents thereof to the converter for retreatment.

93 6. The process of converting high boiling hydrocarbon oils into lower boiling products which comprises cracking a body of oil in the vapor phase, maintaining a body of oil in an unheated still, delivering the products of the vapor phase cracking operation to the body of oil in the still to maintain said oil at a cracking temperature and to effect the cracking of the oil in the liquid phase, delivering the evolved vapors from both the vapor phase and the liquid phase operations to a separator, separating out the lighter constituents thereof and back-trapping the heavier constituents to supply oil for the vapor phase cracking operation.

7. The process of converting high boiling hydrocarbon oils into lower boiling products which comprises continuously delivering a suitable distillate to a vapor phase converter, continuously delivering a heavy oil to an unheated still, delivering the evolved vapors of the converter into the

body of oil in the still whereby said oil is maintained at a cracking temperature sufficient for liquid phase cracking, removing from the still the evolved vapors of both the liquid phase and vapor phase operations, separating out the lighter constituents thereof and continuously returning the heavier constituents to the converter to supply oil to be cracked therein.

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8. The process of converting high boiling hydrocarbon oils into lower boiling products which comprises delivering a heavy oil to a still to supply an initial body of oil thereto, delivering a suitable distillate to a cracking coil where it is cracked in the vapor phase at high cracking temperatures and pressures, discharging the evolved vapors into the body of oil in the still to maintain said body at a sufficient cracking temperature and pressure to effect the cracking of the oil in the liquid phase, taking off the evolved vapors,
supplying a heavy oil to the still, preheating it by
94 the evolved vapors taken therefrom, separating out
the lighter constituents of the evolved vapors and returning the heavier constituents to the vapor phase cracking coil to replace, in whole or in part, the distillate initially supplied thereto.

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9. Apparatus for converting high boiling hydrocarbon oils into lower boiling products in a combined vapor-liquid phase having, in combination, means for cracking oil under pressure and high temperature in the vapor phase, an unheated still, means for supplying oil under pressure thereto, means for delivering the highly heated evolved vapors from the vapor phase converting means into the body of oil in said still to raise and maintain the oil at a temperature sufficient for liquid phase conversion, means for removing from the still the vapors evolved by the combined vapor-liquid phase operation and returning the heavier constituents thereof for retreatment to the vapor phase cracking means.

10. A process of cracking heavier hydrocarbons to produce lighter hydrocarbons which consists in internally heating an externally unheated body thereof in liquid-phase to a cracking temperature under pressure, driving off the cracked hydrocarbons therefrom, condensing the heavier

vapors from said cracked hydrocarbons, separately condensing the lighter vapors, separately heating the condensate from the heavier vapors to vaporize and crack the same and injecting them into said body of hydrocarbons.

11. A process of cracking heavier hydrocarbons
95 to produce lighter hydrocarbons which consists in
internally heating an externally unheated body of heavy hydrocarbons in liquid-phase to a cracking temperature under pressure and distilling the cracked hydrocarbons therefrom, condensing the heavier vapors of the hydrocarbons and heating the condensate from the heavier vapors to a cracking temperature to vaporize and crack the same injecting the cracked vapors into said body of hydrocarbons and separately condensing the lighter vapors from said body.

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12. A process of converting oil, comprising passing oil in a stream through a heating zone to vaporize portions of the oil, heating the vapors and unvaporized oil in said zone to a temperature sufficient to effect cracking thereof, passing the resulting products into an enlarged chamber, maintaining a body of liquid oil in a cracking zone under cracking conditions of temperature and pressure, preheating fresh charging stock and introducing it into said body, and passing vapor and liquid products from said chamber into
said cracking zone in contact with the body of oil
96 therein.

13. The process of cracking heavy hydrocarbon oils, which comprises maintaining a liquid body of heavy oil in a cracking zone under cracking conditions of temperature and pressure, introducing oil into a heating zone where portions of the oil are vaporized and the resulting vapors and unvaporized oil is heated to a cracking temperature, passing the heated products from said heating zone into an enlarged chamber for further cracking, and passing the vapors from said chamber into the body of oil in said cracking zone to maintain a cracking temperature for the oil therein.

14. The process of cracking oil, which comprises vaporizing oil and heating the resulting vapors to a temperature sufficient to crack the same while passing the vapors

through a cracking coil, passing the resulting highly heated and cracked vapors into a chamber where they are brought into direct contact with fresh charging oil for the process, thereby to cool the said vapors and heat the charging oil, and forcing hot oil from said chamber under a mechanically applied pressure to supply oil for said heating and vaporizing operation.

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15. The process of cracking oils, which comprises passing oil from a supply chamber through a heating zone to a separating chamber, heating the oil to a cracking temperature in its passage through said zone, separating carbon and tarry matter from clarified oil in the separating zone and withdrawing the carbon and tarry matter, passing the clarified oil to the supply chamber, removing and collecting the vapors liberated in the said chambers, and introducing fresh oil into the supply chamber.

97 16. The process of cracking petroleum oils, which comprises passing oil to be cracked through a heating zone where the oil is heated to a cracking temperature, delivering the heated oil into a vapor separating zone where a body of oil is maintained at a cracking temperature and where carbon and tar is separated from clarified oil, withdrawing the carbon and tar from said zone, passing vapors from said zone in heat exchange with charging oil in a reflux condenser, passing reflux condensate and charging stock from said condenser and clarified oil from said separating zone into an enlarged chamber, and passing oil from said chamber into said heating zone.

17. A process of distilling oils, comprising passing oil through a heating zone whereby the oil is brought to a distilling temperature, introducing the heated oil into a separating chamber, effecting a separation of residual matter from clear oil in said separating chamber, withdrawing the residual matter, passing the clarified oil into a second chamber, passing the vapors evolved in both chambers into a reflux condensing zone, introducing the oil to be distilled into the vapors in said refluxing zone, passing the introduced oil and reflux condensate into said second chamber to mix with the oil from said separating chamber, and passing the resulting mixture through said heating zone.

18. The process of distilling oil which comprises passing oil to be distilled under a super-atmospheric pressure through a heating zone to heat it to a distilling temperature, passing the heated oil successively through a series of distilling chambers in each of which is maintained a body of oil under super-atmospheric pressure, condensing the vapors evolved from the oil in said chambers, withdrawing residual oils from a plurality of said chambers into
98 a residuum still and effecting the distillation of a substantial portion of said withdrawn residual oil by reducing the pressure thereon.

99 19. An oil distilling apparatus comprising an oil heater, a distilling chamber, means for passing oil under pressure through said heater and into said chamber, means for maintaining a body of oil in said chamber, means for subjecting vapors evolved from said oil to refluxing conditions, a series of condensers, means for passing vapors from said refluxing means through said condensers in series whereby a series of condensates of decreasing boiling point are formed and means for passing one of the lower boiling of said condensates into the vapors in said refluxing means.

20. The process of cracking oil, which comprises passing the oil to be cracked through a heating coil and then into a plurality of enlarged chambers connected in series, permitting vaporization to take place in said chambers and withdrawing the vapors therefron, independently withdrawing unvaporized oil from each of said chambers, passing withdrawn oil from one of said chambers admixed with charging stock through said heating coil to be heated to a cracking temperature, and maintaining a superatmospheric pressure on the oil being cracked.

21. The process of cracking petroleum oil, which comprises passing the oil to be cracked in a confined stream through a dephlegmating zone where the temperature of the oil is raised by heat exchange with vapors, passing the preheated oil into an enlarged zone, discharging vapors from said enlarged zone, conducting oil from said enlarged zone in a stream through a heating zone where the oil is heated to a cracking temperature and then into a chamber where vaporization occurs, passing vapors from said chamber into

said dephlegmating zone, and passing uncondensed vapors therefrom for condensation and recovery.

[Matter enclosed between rules erased in copy.]

100 22. The process of cracking petroleum oil, which comprises heating oil to be cracked to a cracking temperature while passing it in a stream through a heating zone, passing the heated oil into a large reaction zone where conversion occurs, separately removing vapors and unvaporized oil from said reaction zone and introducing the same into a zone maintained under a lower pressure, and subjecting the combined vapors from said zones to reflux condensation in heat exchange with charging stock for the process.

23. An apparatus for the conversion of petroleum oils, comprising a still and a reflux condenser, means for conducting reflux condensate from said condenser into said still, means for passing oil to be cracked into the condenser in heat exchange with vapors and then into said still, an oil heating and converting means, means for passing oil from said still through said heating and converting means to crack the oil, and means for passing vapors from said converting means into said reflux condenser.

[Matter enclosed between rules erased in copy.]

24. The process of cracking heavy hydrocarbons to form lower boiling products, which comprises passing oil from a still through a heating zone where the oil is raised to a cracking temperature, delivering the highly heated oil from said zone into an enlarged vapor separating zone where a body of oil is maintained at a cracking temperature, passing vapors from said zone to a reflux condenser where a reflux condensate is formed therefrom, passing said condensate into said still, and maintaining a higher pressure on the oil in said zones than that maintained in said still.

101 25. The process of cracking petroleum oil, which comprises distilling an oil under sufficient temperature and pressure to crack the same while permitting the products to vaporize, passing the vapors through a series of vapor separating zones maintained under the pressure

of the cracking reaction, in the first zone of which the vapors are brought into intimate contact with feed oil to the cracking process and reflux condensate from a succeeding stage, and in said succeeding stage, are brought to the desired discharge temperature by indirect heat exchange with a liquid cooling medium other than the liquid being treated, and passing the combined reflux and feed oil from said vapor separating zones into the distilling zone.

26. The process of cracking petroleum oil, which comprises passing the oil to be cracked through a heating zone where it is raised to a cracking temperature, passing highly heated oil from said zone through a series of enlarged reaction chambers, removing vapors from said chambers for condensation and collection, passing a gas with the oil passed through said heating zone to actively agitate the oil therein and accelerate the velocity of the oil in said zone, and recirculating oil from one of said chambers back through said heating zone.

27. The process of cracking hydrocarbon oils, which comprises maintaining a body of oil at a cracking temperature in a cracking and vaporizing zone, circulating oil from said body through heating tubes and back to said body to maintain the temperature therein, discharging oil from said body into a separate vaporizing zone maintained under a lower pressure, removing and condensing vapors from the second zone to form a condensate, passing the said condensate through separate heating tubes, and thereafter passing the heated condensate into the said cracking and vaporizing zone.

102 28. An apparatus for producing relatively low boiling point oils, comprising means for heating oil to a cracking temperature while passing therethrough at relatively high velocity, a cracking chamber, means for conducting oil from said heating means to said chamber, means for returning oil from said chamber to said heating means, and means within said chamber causing the oil to move in a circuitous path within the chamber whereby the oil is retained within the chamber a sufficient length of time to complete its cracking reaction therein before being returned to said heating means.

29. An apparatus for producing relatively low boiling point oils, comprising in combination a cracking chamber,

a dephlegmator arranged to drain back into said chamber, a hot fluid condenser to which vapors pass from said dephlegmator, said condenser arranged to drain back into said dephlegmator, a vapor offtake pipe leading from said condenser, and means for introducing raw oil intermediate said dephlegmator and condenser.

30. An apparatus for producing relatively low boiling point oils, comprising a cracking chamber, a dephlegmator receiving vapor from said chamber and arranged to drain back thereto, a hot fluid condenser receiving vapor from said dephlegmator and arranged to drain back into said dephlegmator and a vapor offtake from said hot fluid condenser.

31. An apparatus for producing relatively low boiling point oils, comprising a cracking chamber, a dephlegmator receiving vapors from said chamber and arranged to drain back thereto, a hot fluid condenser receiving vapors from said dephlegmator and draining back into the dephlegmator, a vapor offtake from said hot fluid condenser and a reducing valve in said offtake.

103 32. An apparatus for producing relatively low boiling point oils, comprising a cracking chamber, a dephlegmator receiving vapors from said chamber and arranged to drain back thereto, a hot fluid condenser receiving vapors from said dephlegmator and draining back into the dephlegmator, an oil preheating means, and connections for receiving raw oil from said preheating means and delivering the same to a point intermediate said dephlegmator and condenser.

[Matter enclosed between rules erased in copy.]

33. An apparatus for producing relatively low boiling point oils, comprising means for heating oil to cracking temperature while passing therethrough at relatively high speed, a cracking chamber, means for delivering oil at cracking temperature from said heating means to the upper portion of said cracking chamber, and means for delivering vapor from said heating means to the lower portion of said chamber.

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34. An apparatus for producing relatively low boiling point oils, comprising means for heating oil to cracking

temperature while passing therethrough at a relatively high speed, a cracking chamber, means for moving oil at cracking temperature from said heating means to said chamber, a return connection from the lower portion of said cracking chamber to said heating means, means forming a settling chamber below said return connection, and an offtake from said settling chamber.

35. The process of cracking hydrocarbon oils, which comprises heating oil to be cracked to a cracking temperature while passing the same in a confined stream through a heating zone, passing the heated oil into a plurality of converting zones wherein the oil is maintained under cracking conditions of temperature and pressure to convert portions of said oil into lower boiling products, passing a gas in contact with the oil in said heating zone, and alternately withdrawing residue from said converting zones to control the concentration of the carbon and tar in the oil therein.

104 36. The process of cracking petroleum oils to form lower boiling products therefrom, which comprises heating oil to a cracking temperature, passing the heated oil into a plurality of converters, maintaining the oil in said converters under cracking conditions to convert portions of said oil to lower boiling products, subjecting the vapors from said converters to condensing conditions to condense a portion of said vapors, returning reflux condensate to one of said converters, selectively withdrawing liquid oil from said converters to control the concentration of tarry matter in the oil in said converters, and passing a gas in intimate contact with the oil in one of said converters.

37. The process of cracking hydrocarbon oils to form lower boiling products therefrom, which comprises heating oil to a cracking temperature, passing the heated oil into a plurality of converters, maintaining the oil in said converters under cracking conditions to convert portions of said oil into lower boiling products, subjecting the vapors from said converters to condensing conditions to condense a portion of said vapors and form a reflux condensate, and selectively withdrawing liquid oil from said plurality of converters.

38. The process of treating hydrocarbon oils, which comprises passing the oil to be treated in a confined stream through a heating zone wherein the oil is heated to a temperature below 900° F., passing air through said zone in intimate contact and in parallel with the oil passing therethrough, separating unvaporized oil from the vapor products formed in said zone and returning unvaporized oil to said zone, and separating the condensible products of said vapors from normally uncondensible gaseous constituents.

105 IN TESTIMONY WHEREOF I affix my signature.

HENRY L DOHERTY
(Inventor's Full Name)

Oath

CANADA, COUNTY OF YORK
Province of Ontario, ss.

I, Henry L. Doherty, the above-named petitioner, being duly sworn, depose and say that I am a citizen of the United States of America, and resident of New York, N. Y., and that I verily believe myself to be the original, first and sole inventor of the improvements in

"PROCESS OF DISTILLING OILS"

described and claimed in the annexed specifications; that I do not know and do not believe that the same was ever known or used before my invention or discovery thereof, or patented or described in any printed publication in any country before my invention or discovery thereof, or more than two years prior to application Serial No. 361,030, filed February 24, 1920, of which this application is a division, or in public use or on sale in the United States for more than two years prior to said application; that said invention has not been patented in any country foreign to the United States on an application filed by me or my legal representatives or assigns more than twelve months prior to said application; and that no application for patent on said improvements has been filed be me or my representatives or assigns in any country foreign to the United States.

HENRY L. DOHERTY
(Inventor's Full Name)

Subscribed and sworn to before me this 28th day of December, 1928

HUGH H. DONALD
(Seal) *(Signature of Notary Public)*

110 Endorsed: Mailed June 19 1929

Div. 31 Room 312 CSD/MR Paper No. 3

Department of Commerce

United States Patent Office
Washington

Address only
"The Commissioner of Patents,
Washington, D. C.,"
and not any official by name

All communications respecting this
application should give the serial number,
date of filing, and name of
the applicant

Please find below a communication from the Examiner in charge of this application.

THOMAS E. ROBERTSON
Commissioner of Patents.

Applicant: Henry L. Doherty
Ser. No. 333650
Filed January 19, 1929
For Process of Distilling Oils

Edmund G. Borden
60 Wall Street,
New York, N. Y.

Letter filed June 11, 1929 is of record.

This application is informal in that the papers are not ribboned as provided by Rule 47. Before allowance duplicate papers prepared in compliance with Rule 47 must be filed.

Claims 5, 6, 7, 8, 10 and 11 are rejected as unwarranted by the disclosure on the ground that applicant does not disclose vapor phase cracking in pipe still 54. Claim 10 is further rejected as unwarranted in that applicant does not disclose "separately heating the condensate".

Claim 9 may be allowed.

An interference will be set up in due course on claim 9 with the parties Isom, Taveau and Brandt. If applicant further desires to contest his right to make claims not included in the declaration of the interference, he can proceed under Rule 109. See also Rule 94.

Action on the remaining claims in the case is held in abeyance pending termination of the interference.

W. N. HOLMES
Examiner.

111 Endorsed: Mail Division Dec 31 29 U. S. Patent Office

Endorsed: Docket Division Dec 31 1929 U. S. Patent Office

Div. 31. Room 312 Paper No. 4.

In the United States Patent Office

Application Henry L. Doherty.
Serial No. 333,650. Filed January 19, 1929.
For Process of Distilling Oils.

Hon. Commissioner of Patents,
Washington, D. C.

Sir:

In the matter of the above entitled application please enter the following amendment.

Add the following claims:

—39. Apparatus for converting high boiling hydrocarbon oils into lower boiling products in a combined vapor liquid phase, having, in combination, means for cracking oil under pressure and high temperature in the vapor phase, an unheated heat-insulated still, means for supplying oil under pressure thereto, means for delivering the highly heated evolved vapors from the vapor phase converting means into the body of oil in said still to raise and maintain the oil at a temperature sufficient for liquid phase conversion, means for removing from the still the vapors evolved by the combined vapor-liquid phase operation and returning the heavier constituents thereof for retreatment to the vapor phase cracking means.—

—40. Apparatus for converting high boiling hydrocarbon oils into lower boiling products having, in combination, an elongated tubular converter, means for passing oil therethrough under pressure, means for subjecting the oil in transit to sufficient temperature to crack it in the vapor phase, and unheated heat-insulated still, means for supplying and maintaining a body of oil therein, means for delivering the vapors derived from the vapor phase cracking operating into the body of oil in said still whereby
112 the vaporization of said oil is effected, means for removing the vapors from said still, means for condensing out the heavier constituents thereof and returning them to the vapor phase tubular converter for retreatment and means for condensing and collecting the lighter constituents of desired volatility.—

—41. The process of converting high boiling hydrocarbon oils into lower boiling products which comprises cracking a suitable distillate in the vapor phase, cracking a heavy oil in the liquid phase, delivering the evolved vapors from both cracking operations to a separator, separating out the lighter constituents and delivering the heavier constituents to supply oil for the vapor phase cracking operation.—

—42. The process of converting high boiling hydrocarbon oils into lower boiling products which comprises cracking a suitable distillate in the vapor phase under suitable temperature and pressure conditions, utilizing the heat of the evolved vapors of the vapor phase cracking operation to supply heat to a body of oil under pressure in a still to maintain the necessary cracking temperature to effect its conversion in the liquid phase, taking off from the still the evolved vapors of the combined vapor phase and liquid phase cracking operation, separating out the lighter constituents thereof and returning the heavier constituents to supply oil for the vapor phase cracking operation.—

113 —43. The combined process for cracking oils in liquid and vapor phase, which comprises introducing a stream of oil containing reflux condensate derived from the process into a cracking zone in which the oil is heated to a temperature sufficient to vaporize and crack portions thereof in the vapor phase, conducting the hot vapor prod-

ucts from said zone into a body of oil maintained in a second cracking zone, intimately contacting said hot vapor products with the oil of said body whereby portions thereof are cracked in liquid phase, and subjecting the combined vapors produced from the cracking operations to reflux condensation.—

—44. The combined process of cracking relatively high boiling point oils in liquid and vapor phase into oils of lower boiling point, which comprises subjecting a distillate oil to cracking conditions of temperature and pressure in a zone in which portions of said distillate are cracked in vapor phase, conducting the resulting highly heated vapor products into a second cracking zone in which a body of oil is maintained under cracking conditions of temperature and pressure, intimately contacting said highly heated vapors with the oil of said body to thereby heat and crack portions thereof in liquid phase, and subjecting the vapors from both cracking operations to fractional condensation to separate the desired low boiling point constituents from the higher boiling point constituents.—

[Matter enclosed between rules erased in copy.]

Remarks

The above amendment is presented in connection with applicant's motion to amend under Rule 109, and intended to accompany the motion for the purpose of adding counts to Interference #58,781.

Respectfuly submitted,

EDMUND G. BORDEN
Attorney for Applicant.

2—079

114 *Interference.*

CSD/nh

Interference No. 58781 Paper No. 4
Name, Henry L. Doherty
Serial No. 333650
Title, Process of distilling oils
Filed, Jan. 19, 1929,
Interference with Rene de M. Taveau, Edward W. Isom and David G. Brandt.

Decisions of

Law Examiner, ...	Dated, ...
Ex'r of Interferences, ...	Dated, ...
Board, Reversed in part	Dated, June 1-1931
Commissioner, ...	Dated, ...

Remarks:

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This should be placed in each application or patent involved in interference in addition to the interference letters by Primary Examiner.

125 Endorsed: Paper No. Jun 13 1932 Division 31

Endorsed: Mail Room Jun 11 1932 U. S. Patent Office

Div. 31. Room 4716. Paper No. 8.

In the United States Patent Office

Application: Henry L. Doherty.
Serial No. 333,650. Filed Jan. 19th, 1929.
For: Process of Distilling Oils.

Hon. Commissioner of Patents,
Washington, D. C.

Sir:

In response to the Office Action dated December 11th, 1931, please amend the above entitled application as follows:

Claim 2, line 4, change "resulting vapors" to—oil constituents therein—

line 6, cancel "vapors" and substitute—highly heated oil constitutents from said zone and passing the vapors thereof—

Claim 3, line 4, after "vapors" insert—and any unvaporized oil constituents present therein—

Claim 4, line 6, change "a" to—an externally unheated—

line 9, change "it is" to—they are—

line 11, before the *period* insert—into direct contact with the body of oil therein to supply the entire heat necessary for cracking the oil of said body—

Claim 5, line 4, after "convert" insert—a portion of—

line 10, after "returning" insert—at least a portion of—

Claim 7, rewrite line 3 as follows:—tinuously de-
126 livering oil to be cracked including a suitable distillate to a highly heated—

lines 8 and 9, cancel "liquid phase and vapor phase" and substitute—cracking—

line 10, before "the" insert—at least a portion of—

Claim 8, line 4, after "delivering" insert—oil including at least in part—

line 5, change "it" to—at least a portion thereof—

line 12, after "returning" insert—at least a portion of—

line 13, cancel “vapor phase”

line 14, change “distillate” to—oil—

Claim 11, line 5, change “the” to—portions of the hydrocarbons including the relatively low boiling point—

line 6, change “and heating the” to— , heating at least a portion of the—

rewrite line 8 as follows:—in a zone in which vaporization occurs, injecting the resulting cracked—

line 9, insert a *comma* before “and”

127 Claim 15, line 5, change “clarified oil” to—a mixture of oil, carbon and tarry matter—

Claim 16, line 6, change “clarified oil” to—oil with which it is mixed—

Claim 17, line 5, cancel “clear”

cancel line 7 and substitute—enlarged zone, passing vapors evolved in said chamber and enlarged zone into a—

line 10, change “chamber” to—enlarged zone—

Claim 21, line 3, change “dehplegmating” to—partial condensing—

same line, after “by” insert—indirect—

line 5, after “zone” (2nd) insert—for condensation—

line 8, after “then” insert—conducting the highly heated and cracked oil—

line 9, change “dephlegmating” to—partial condensing—

Claim 24, line 9, after “a” insert—substantially—

Claim 25, line 4, after “vapors” insert—resulting from said cracking—

same line, change “separating” to—condensing—

line 7, change “to” to—for—

Rewrite line 8 as follows:—from a succeeding condensing zone, cooling the vapors in said succeeding condensing zone—

line 9, cancel “brought”

line 12, change “separating” to—condensing—

Claim 37, last line, before the *period* insert—to control the concentration of the tarry matter in the oil therein—

Claim 38, rewrite line 7 as follows—said zone,
128 passing separated vapors and unvaporized oil in counter-current and in intimate contact with each other in an enlarged zone, returning unvaporized oil to said heating zone, and sep- —

Claim 43, line 2, cancel “in liquid and vapor phase” line 5, cancel "and crack"

rewrite line 6 as follows:—and to crack a substantial portion of the oil constituents, conducting the resulting hot vapor products from—

lines 9 and 10, cancel "in liquid phase" and substitute—to lower boiling point products—

Claim 44, line 2, cancel "in liquid and vapor phase"

line 6, change "cracked in vapor phase" to—vaporized—

line 11, cancel "in liquid phase"

Claim 1, line 5, after "crack" insert—a substantial portion of—

last line, change "cracked" to—subjected to the cracking conditions maintained therein—

Cancel claims 6, 9, 10, 14, 18, 19, 20, 23, 26 to 32, 34, 35 and 39 to 42 without prejudice.

129 *Remarks*

Claim 9 comprising the issue in Interference No. 58,781 has been cancelled as well as claims 6 and 39 to 42 which were proposed counts in said interference. The subject-matter of claim 42 is believed to be sufficiently covered in certain of the claims which have been retained.

Claims 1, 2, 3, 5, 7, 8, 11, 43 and 44 which were also proposed counts in said interference have been amended and retained in the application. The rejection of these claims as amended is believed to be entirely unwarranted. The applicant discloses the treatment of various charging stocks such as gas oil and kerosene. It is obvious that in the cracking of these two stocks in chamber 36 the reflux condensate produced therefrom in the refluxing section of chamber 36 will not differ substantially from the charging stock and therefore will reach the bottom of chamber 36 to the point of the withdrawal line 46 and be conducted to the cracking coil 54. The Examiner is directed to the applicant's briefs filed in the above-mentioned interference before the Examiner of Interferences and the Board of Appeals for a further discussion of this question. The Examiner is also respectfully referred to Dubbs patent #1,534,927 and particularly to some of the claims such as claim 12 which has been allowed on a process covering the return of reflux condensate to a cracking chamber, and passage of a mixture of such condensate and unvaporized oil

to a cracking coil. Note also the patent to Von Groeling and the more recent patent to Egloff #1,733,654. The Examiner must also realize the fact that in the early type of cracking carried out in Burton stills the reflux condensate was continuously returned to the cracking chamber and subjected to further treatment in admixture with the
130 oil being treated. If the conclusions of the Examiner of Interferences and the Board of Appeals were correct, reflux condensate thus returned to a cracking chamber would be so instantly vaporized that there would be no cracking of such condensate. The applicant is prepared to prove that reflux condensate returned to the body of oil maintained in chamber 36 mingles therewith, and that substantial portions of the condensate are withdrawn through the line 46 and conducted to the cracking coil 54.

Favorable consideration and allowance of claims 1, 2, 3, 5, 7, 8, 11, 43 and 44 as amended are requested.

Claim 4 has been amended in the manner suggested and is not unwarranted by the disclosure in view of the remarks made above in connection with claim 1, etc.

Claim 4 is not met by patents to Burton or Hanna, since Burton does not disclose the heat exchange and the features of cracking an externally unheated body of oil by the products of cracking a stream of oil passed through a heating coil. The patent to Hanna does not disclose the preheating of a charging stock and introducing it into the body of oil in a still wherein the heating is conducted by intimate contact of highly heated oil products from a cracking zone. Claim 4 is believed to cover subject-matter sufficiently similar to claims 1 to 3 and therefore clearly allowable.

Claim 12 is not met by the combination of Holmes and Hanna. The chamber 2 of Holmes is in no sense a zone through which a stream of oil may be conducted and heated to a cracking temperature, and it is illegal to add the heating coil of Hanna on to the series of chambers disclosed by Holmes. There is no suggestion in either of these patents where a heating coil is used in connection with an enlarged chamber, of introducing the charging stock after pre-
131 heating directly into the chamber instead of passing it through the coil. Claim 12 is therefore believed to be clearly allowable.

Claims 13, 22 and 33 are improperly rejected on the claims of the applicant's prior patent No. 1,597,674 since the claims of this patent are all limited to a cracking process involving pressure reduction on unvaporized residuum. The Examiner has not mentioned any particular claim of said patent, and it is submitted that no claim is in conflict with the claims here being prosecuted.

Claim 14 has been cancelled. Claims 15, 16 and 17 have been amended to avoid the objections raised by the Examiner. These claims are not met by Dubbs patent No. 1,534,92 or any combination thereof with the patents to Hanna or Dubbs No. 1,690,997. These claims define a cracking process materially different from that disclosed by Dubbs, since the oil from the cracking coil is introduced into the separating chamber from which unvaporized residuum oil containing carbon and tarry constituents are withdrawn as through pipe 113. The relatively clear oil from chamber 112 is conducted into chamber 36 where it is mingled with fresh charging stock and reflux condensate. Dubbs operation is substantially different from this since the fresh charging stock is introduced into chamber K′ and no carbon and tarry matter is withdrawn therefrom. Dubbs passes the carbon and tar along with other oil into chamber K^3 in which a separation is made, but the fresh charging stock is not introduced into this chamber. The applicant's system provides an effective method for securing a relatively clean stock for the cracking in the coil and effectively eleminates carbon and tarry constituents. Claims 15, 16 and 17 should therefore be allowed.

132 Claim 21 has been amended to avoid the Examiner's objections and correct the alleged inaccuracy. This claim is not met by the Dubbs patent No. 1,525,281 because there is no disclosure of the preheating of the oil subjected to cracking and because the coils B B may be used either to heat or cool. Claim 21 specifies the cracking of the oil which has been subjected to the indirect heat exchange in the partial condensing zone and is clearly allowable over the Dubbs patent.

Claim 24 which has been rejected on the patent to Dubbs No. 1,534,927 in view of Jenkins does not read on such a combination. In fact the attempt to combine such patents is believed to be improper since it would be impossible to use a lower pressure in chamber K^3 of Dubbs than that used in K'. Vapors from these two chambers pass together through the reflux condenser Q and through pressure regulating valve D'. The patents therefore cannot be combined. The Examiner is familiar with the fact that something more than apparatus must be disclosed in order to anticipate the features of a process. The apparatus disclosed by these two patents cannot be combined for the foregoing reasons, and there is no suggestion of the process. Claim 24 should be allowed.

Claim 25 has been amended to avoid the Examiner's objections, and it is believed that the claim clearly distinguishes over Dubbs patent No. 1,525,281. This claim specifies successive condensing zones thru which the vapors pass in a series, and the patent relied upon has no such corresponding disclosure. The indirect heat exchange and direct contact in the Dubbs patent occur in the same zone and therefore claim 25 should be allowed as amended.

Claims 36 and 37 cover a cracking process in which
133 oil is heated to a cracking temperature and introduced into a plurality of enlarged converters wherein the oil is converted into lower boiling products. The claims also specify the selective withdrawal of liquid oil (residuum) from the converters to control the concentration of tarry matter in the oil therein. The Dubbs patent No. 1,534,927 relied upon by the Examiner against these claims, discloses two enlarged chamber K' and K^3, but residuum is not withdrawn from the chamber K', but only from chamber K^3. The residuum must be withdrawn from several chambers in order to secure a selective withdrawal. The Dubbs patent does not disclose this feature and therefore claims 36 and 37 should be allowed.

Claim 38 which was rejected on Dubbs No. 1,534,927 in view of Wingett has been amended in a manner which is believed to clearly distinguish the claims over the attempted combination of references. The claim now specifies the intimate contact and counter current flow of vapors and unvaporized oil in an enlarged zone (36) which feature is not disclosed in any of the patents. There is no basis for combining the disclosure of Wingett with the disclosure of Dubbs, and claim 38 as amended is believed to be in allowable condition.

The number of claims presented in this application have been very substantially reduced, and the claims retained carefully compared and considered in connection with the references relied upon. The claims retained in most cases have been amended to avoid the Examiner's objections, and to clearly distinguish the claims over the patents relied upon as references.

134 Favorable consideration of the claims retained and allowance of the case is now in order.

Respectfully submitted,

EDMUND G. BORDEN
Attorney for Applicant.

New York, N. Y.
June 10, 1932.

140 Endorsed: Paper No. May 25 1933 Division office

Endorsed: Mail Division May 24 33 U. S. Patent Office

Div. 31. Room 4716 Paper No. 10

In the United States Patent Office

Application : Henry L. Doherty
Serial No. 333,650. Filed Jan. 19, 1929.
For: Process of Distilling Oils.

Hon. Commissioner of Patents,
Washington, D. C.

Sir:

In response to the Office Action dated November 25th, 1932, enter the following amendments to the above-entitled application:

Claim 3, cancel the insert to line 4, and substitute—and any unvaporized oil constituents present therein while passing through said zone—
Cancel claims 21, 25, 36 and 37.

Remarks

The rejection of claims 1, 2, 3, 5, 7, 8, 11, 43 and 44 in view of the holdings in Interference No. 58,781, is still believed to be entirely unwarranted. Furthermore the applicant intends to prosecute his statuatory appeals necessary for the protection of his invention defined by these claims. It is obvious that the application discloses the cracking of both liquid and vaporized oil constituents in the cracking coil regardless of the opinion stated by the Board of Appeals. It is furthermore evident that the application discloses the cracking of reflux condensate as specified by certain of these claims. The Examiner in fact recently declared an interference

150 Endorsed: Paper No. 12 Apr 5-1934 Division 31

Div. 31. Room 4716 Paper No. 12

Endorsed: Mail Division Apr-4 34 U. S. Patent Office

In the United States Patent Office

Application: Henry L. Doherty
Serial No. 333,650. Filed Jan. 19, 1929.
For: Process of Distilling Oils.

Hon. Commissioner of Patents,
Washington, D. C.

Sir:

In reply to the Office Action of October 6th, 1933, kindly amend the above-entitled applications as follows:

Claim 1, line 1, after "A" insert—continuous—
Claim 1, rewrite line 4 as follows:—said zone and heating the resulting vapors and unvaporized oil of said stream to—
line 6, change "a cracking zone where a" to—an unheated cracking zone in which an enlarged—
line 7, after "of" insert—liquid—
Claim 2, line 1, after "A" insert—continuous—
line 1, change "oil" to—and cracking oil for the production of gasoline—
line 6, change "a body of oil in a" to—an enlarged body of oil in an unheated—
Claim 3, line 2, before "passing" insert—continuously—
line 5, change "a" to—an enlarged—
line 6, change "in a cracking chamber" to—at a cracking temperature in a cracking chamber to which no extraneous heat is applied—

151 Claim 4, line 1, after "A" insert—continuous—
line 6, change "a" to—an enlarged—
line 7, cancel the *comma*
line 8, after the *comma* insert—continuously—
Claim 5, line 2, change "products which comprises passing" to—gasoline-like products, which comprises continuously passing a stream of—
line 5, change "a" to—an enlarged—
line 6, after the *comma* insert—introducing fresh charging stock into said still,—
Rewrite claim 7 as follows:

—45. A process of converting high boiling hydrocarbon oils into lower boiling gasoline-like products, which comprises continuously delivering oil to be cracked including a suitable high boiling distillate to a highly heated converter in which vaporization and cracking of portions of the oil occurs, continuously delivering a heavy fresh oil charging stock to an unheated still and maintaining an enlarged body of oil therein, delivering the evolved vapors from the oil heated in the converter into the body of oil in the still thereby to heat said oil and maintain the same at a cracking temperature sufficient for liquid phase cracking, removing from the still the evolved vapors of both cracking portions, separating out the lighter constituents thereof and continuously returning at least a portion of the heavier constituents to the converter to supply oil to be cracked therein.—

152 Claim 8, line 2, after "boiling" insert—gasoline-like—
line 3, change "a still" to—an unheated still—
line 4, before "to" insert—continuously—
Rewrite claim 11 as follows:

—46. A continuous process for cracking heavier hydrocarbons to produce lighter gasoline-like hydrocarbons, which consists in internally heating an externally unheated body of heavy hydrocarbons in liquid phase to cracking temperature under superatmospheric pressure and distilling portions of the hydrocarbon including the relatively low boiling point cracked hydrocarbons therefrom, introducing fresh charging stock to said body of hydrocarbons, condensing the heavier vapors of the distilled and vaporized hydrocarbons, heating at least a portion of the condensate from the heavier vapors to a cracking temperature while passing in a continuous stream of restricted cross section through a heating zone in which vaporization occurs, injecting the resulting cracked vapors into intimate contact with the hydrocarbons of said body, and separately condensing the lighter vapors removed from said body.—

Claim 12, line 2, before "stream" insert—continuous—

Claim 12, line 6, change "a body of liquid oil in a" to —an enlarged body of liquid oil in an unheated—

last line, before the *period* insert—thereby to maintain the body of liquid oil at a cracking temperature—

Claim 13, line 1, before the *comma* insert—for the production of gasoline—

153 line 2, change "in a" to—in an unheated—

line 4, after the *comma* insert—continuously—

Claim 16, line 4, change "a vapor separating zone where a" to—an unheated vapor separating zone in which an enlarged—

line 10, before "oil" insert—tar- and carbon-free—

Claim 17, line 6, before the *comma* insert—from the system—

Claim 24, line 2, after "boiling" insert—gasoline—

same line, after "comprises" insert—continuously—

line 2, cancel "a"

rewrite line 3 as follows—an enlarged body of oil maintained in a still in a stream of restricted cross section through a heating zone where the oil is raised to a high—

Claim 33, line 2, after "means" insert—including a long coil—

line 4, change "a" to—an unheated—

Rewrite claim 43 as follows:

—47. The combined process for cracking oils to produce gasoline, which comprises continuously passing a restricted stream of oil containing reflux condensate derived from the process through a heating and cracking zone in which the oil is heated to a temperature sufficient to vaporize portions thereof and to crack a substantial portion of the oil con-
stituents passing therethrough, conducting the re-
154 sulting hot vapor products from said cracking zone
into an enlarged body of oil maintained in a second
externally unheated cracking zone, intimately contacting said hot vapor products with the oil of said body whereby

portions thereof are cracked to lower boiling point gasoline-like products, introducing charging oil into said second zone, and subjecting the combined vapors produced from the cracking operations to reflux condensation.—

Rewrite claim 44 as follows:

—48. The combined process of cracking relatively high boiling point oils into oils of lower boiling point for the production of cracked gasoline, which comprises continuously passing a distillate oil in a confined stream of restricted cross section through a heating zone in which the distillate oil is subjected to cracking conditions of temperature and pressure and in which zone portions of said distillate are vaporized, conducting the resulting highly heated vapor products into a second cracking zone to which no outside heat is supplied and in which an enlarged body of oil is maintained under cracking conditions of temperature and pressure, intimately contacting said highly heated vapors with the oil of said body to thereby heat and crack portions thereof, and subjecting the vapors from both cracking zones to fractional condensation to separate the desired low boiling point gasoline constitutents from the higher boiling point constituents.—

155 Add the following claim:

—49. A process for distilling petroleum oils, comprising passing a continuous stream of oil of restricted cross section through a heating zone wherein the oil is heated at a superatmospheric pressure to a temperature in excess of that required to vaporize substantial proportions of the oil, introducing the stream of highly heated oil into a separating zone in which unvaporized oil constituents are separated from oil vapors, passing an inert gas in intimate contact with the separated unvaporized oil constituents resulting from said heating, passing the separated vapors together with the gas passed in contact with said unvaporized oil constituents through a series of vapor fractionating zones in which the vapors are subjected to successively lower temperatures and in which fractions of the vapors are condensed and separately removed, and finally separating the inert gaseous constituents from lower boiling condensible hydrocarbons.—

156 Remarks

The claims of this application have been carefully reconsidered in view of the last Office Action, and many of them have been amended, mainly for the purpose of improving their form or to more clearly define the subject-matter intended to be covered. Some of the amended claims have been completely rewritten in order to avoid an excessive number of insertions.

A number of the claims of this application were considered by the Examiner of Interferences and the Board of Appeals in Interference No. 58,781 *and held to cover patentable subject-matter.* The Examiner's rejection of such claims on references is therefore entirely *inconsistent* with the idea of holding these claims rejected on the grounds used by the Examiner of Interferences, that is, that the claims are not supported by the Doherty disclosure. The applicant has previously indicated his intention to retain such claims and has traversed all rejections made on the grounds of insufficient disclosure. Under the conditions, therefore, the Examiner cannot properly stand by the Examiner of Interferences in the one case and reverse him on the ground of patentability. In this respect, therefore, the Examiner should reconsider claims 1, 2, 3, 5, 7 (45), 8, 11 (46), 43 (47) and 44 (48). Applicant is submitting proof to show that heavy condensate produced in tower 36 is returned to the pipe still through line 46 with the oil to be cracked. The only other point raised by the Examiner of Interferences relates to the idea of vapor cracking in the pipe still itself. As previously pointed out, the specification definitely discloses vaporization and the heating of the resulting
157 vapors along with the unvaporized oil to a cracking temperature (page 6).

The rejections made by the Examiner on references, almost invariably include a combination of two or more patents in an attempt to anticipate the claims rejected. The Examiner of Interferences and the Board of Appeals repeatedly refused to combine references against process claims, even though such combination was urgently insisted upon by one of the parties to Interference No. 58,780. It is therefore believed that unless the combination of references is more or less obvious, the Examiner should waive the use of such rejections on process claims (See Carnegie Steel Company case and page 3, last amendment).

Claim 1 has been rejected on the Cosden patent in view of Trumble. The Cosden patent does not disclose the cracking of the vapors evolved in the large cylindrical still 1, even though these vapors may be superheated during the slight amount of contact in a small section of the vapor line 3. Cosden furthermore fails to disclose an enlarged body of liquid oil in chamber 4 but merely sprays oil, which is not preheated, into the vapors discharged from the line 3. Claim 1 calls for the maintenance of an enlarged body of liquid oil which is cracked by the introduction of highly heated vapors resulting from the *vaporization and cracking of oil constituents passing through a heating zone in a stream.* Claim 1 also calls for the production of reflux condensate and the returning of at least a portion of such condensate to the heating zone.

Claim 2 as well as claims 43 and 44 (47 and 48) were also rejected on Cosden in view of Trumble, but these claims distinguish clearly over the combination of these patents for the reasons pointed out above. There is no sug-
158 gestion that the cracking coil of Trumble could be substituted for the still 1 of Cosden in his combination of apparatus. Such a substitution would produce entirely different results from Cosden and was never contemplated. If all of the oil constituents of the Trumble coil were mixed with the high temperature gas of Cosden and the whole mixture supplied to Cosden's chamber 4, the large amount of residue would defeat the objects of Cosden, who intends to use only the vapors from the still 1.

Claim 1 has also been rejected on the patent to Rosenbaum in view of Setzler, in spite of the fact that the Examiner knows that Rosenbaum merely discloses a *batch* process or operation in which a charge of crude oil is introduced to the still 1, and subjected to heat from the furnace 2 as in the usual Burton type operation. The only distinction disclosed by Rosenbaum is the collection of the reflux condensates, *after* the natural gasoline has been removed from the crude oil, and the heating of these condensates in a coil furnace and then introducing such material into the body of residue in the still 1. The condensates are only treated intermittently and are heated entirely in liquid phase. (page

1, line 36; page 2, lines 49 to 76 and 115 to 126). After Rosenbaum once charges the still 1, there is no further addition of oil charging stock. Claim 1 covers a *continuous* process which is not so much as suggested by Rosenbaum even when combined with the additional preheated charging stock as disclosed by Setzler. The fact is that these references cannot be combined because Rosenbaum discloses nothing more than a batch process. Rosenbaum has also been used in various combinations in the rejection of several other claims
of this application, but it is apparent from the fore-
159 going remarks that such rejections should be waived
because the claims now clearly and specifically cover
a continuous process.

Claims 2, 43 and 44 have also been rejected on the patent to Knox in view of Cosden. The latter patent as shown above, is defective as a reference, since it does not disclose an enlarged body of liquid oil and Knox is defective as a reference for reasons pointed out in previous amendments. The patent to Knox does not pass *condensate* through his heating zone, but incidentally may pass some vapors through the heating zone. Knox has for his primary object the production of a very high temperature heating *gas* so that any vapors passed through the gas heating zone *are* completely cracked to fixed gas at temperatures in the neighborhood of 1300°F. The claims referred to distinctly specify that the process has as an object the production of *gasoline.* Knox does not disclose the production of gasoline in his heating zone, and it is obvious that he would produce none, even though incidentally certain vapors might be passed thereinto. The applicant has previously pointed out the fact that the Knox disclosure is inoperative for the passage of vapors through the line 43, but the Examiner apparently ignored this condition. As pointed out above, however, even if vapors are introduced into the line 29 from 43, they will be completely cracked to fixed gas so that the operation has no similarity to that defined by claims 2, 47 and 48.

In certain of the rejections, for example in the rejections of claims 2, 3, 43 and 44, the Alexander patent has been used in combination with Rosenbaum. This patent not only fails to disclose the cracking of oil brought into contact with

vapors, but also fails to disclose the maintenance of
160 an enlarged body of liquid oil. The applicant is not
claiming a broad tube cracking process, but he is claiming a novel combination of cracking operations which are not disclosed by any of the references. Alexander discloses the cracking of oil vapors, but he does not disclose the combination of such cracking with the cracking of an enlarged body of liquid oil solely by internal heating.

Claims 3 and 44 (48) were rejected on Sherman. These claims now definitely specify that the applicant's process is a continuous cracking process and contain other limitations which are not disclosed by Sherman. Sherman's operation is distinctly a batch or intermittent operation in spite of the fact that condensates are returned into a header 6 and heated in coil 7. These condensates are not passed continuously into the heating coil (page 2, lines 60 to 71). There is also no indication that charging oil is introduced into Sherman's still 1 during the heating operation. The rejection on Sherman should be waived.

Some of the claims such as claims 4, 5, 7, 8 and 11 were rejected on Dubbs patent No. 1,534,927, but this patent is not a pertinent reference against these claims for the following reasons:

1. The patent discloses a liquid phase cracking operation in the tubes B.

2. The patent discloses a batch operation without the continuous introduction of charging stock (page 2, lines 55 to 70).

3. This patent does not disclose the cracking of the oil in the chamber K′. When charging stock is introduced into the system during operation, it serves to *absorb* heat from the oil discharged from the coil (page 3, lines 32 to 38).

4. The Patent Office has granted Dubbs a patent No. 1,686,654 based on the disclosure of Dubbs No. 1,534,927 which specifically claims *liquid phase* cracking in the coil and the *cooling* of the oil discharged from the coil by the introduction of cold charging stock from the pump J.

161 The claims referred to above define a distinctly different process in which the oil is not only cracked in the coil, but at least partially vaporized therein and the resulting highly heated constituents conducted into an enlarged body of liquid oil to crack the constitutents of such body. Dubbs discloses a liquid phase coil operation and

fails to disclose the cracking of the liquid body of oil. The Dubbs patent not only fails as a reference but discloses a process which is directly opposite to that defined by the claims. The rejection of any of the claims on the Dubbs patent should therefore be waived.

In some cases the patent to Von Groeling has been combined with Dubbs to show the preheating of the oil. Dubbs primary object (apparently) in view of the issue of his patent No. 1,686,654 is to *chill* the oil discharged from the cracking coil B, therefore the preheating of the oil as disclosed by VonGroeling would be entirely inconsistent.

Claim 4 as amended is not met by the patents to Hanna and Burton. The discharge from the Hanna coil 9 is not brought into intimate contact with the body of oil in the evaporator 5. Furthermore, there is no disclosure that any cracking takes place in the evaporator. Hanna's object is to suspend the oil to be cracked in a relatively refractory carrying medium and to heat the two in his coil. The refractory medium is immediately vaporized in the chamber 5 and the residue is drained through the line 21. The Burton patent discloses substantially a batch operation, while claim 4 now specifies that the process is continuous. Burton furthermore fails to disclose the use of a cracking coil, his recirculating tube boiler not being in any way equivalent to the use of a pipe still furnace. The Burton patent also fails to meet the terms of claim 4 because the charging stock is not introduced into the body of oil, but 162 passes through the funnel 29 to the boiler tubes 10. This defect is also true of the Hanna patent in which the charging stock goes to the cracking coil and not to chamber 5. Claim 4 is therefore clearly allowable.

Claim 5 was also rejected on the Behimer as well as Rosenbaum patent in view of Behimer. Rosenbaum is defective as a reference for the reasons pointed out above, and the attempted combination therewith of Behimer does not remove the deficiency. Claim 5 as amended distinguishes from Behimer which does not disclose the introduction of charging stock into the enlarged chamber. Claim 5 specifies the cracking of oil while it is being passed through a converter and *also* the cracking of an enlarged body of liquid oil. Behimer appears to have as his primary object the cracking of oil in his chamber, and therefore heats this chamber externally and claims to prevent any substantial decomposition in his heating coil (page 1, lines 41 to 53). Behimer therefore does not constitute a proper reference against claim 5, and for the same reasons does not anticipate claim 11.

Claim 12 which was rejected on Biddison in view of Von Groeling, clearly distinguishes therefrom because these references are improperly combined, and because Biddison does not disclose the essential parts of the process. If Biddison separated out his liquid oil constitutents in the separator 3, he would not have any liquid body of oil in chamber 8. It is apparent therefore that the element 3 is merely a trap in a line through which carbon and tar may be intermittently removed. It seems obvious that Biddison lacks even a suggestion of the process defined by claim 12. Von Groeling cannot be combined with Biddison because
163 the introduction of charging stock into the chamber 8 would entirely alter the Biddison process. These observations are also true with respect to claims 15, 16 and 17. The rejection of claims 12, 15, 16 and 17 on Biddison in view of Von Groeling, or the last two claims on Biddison in view of Hanna, is entirely unwarranted, and should be waived.

Claim 13 was also rejected on Barbet in view of Dubbs patent No. 1,525,281. The applicant has tried to visualize the manner in which the Examiner apparently read claim 13 on Barbet, but fails to find anything approaching the two stage cracking process specified by this claim. Barbet cracks only in the still 7 and has no other cracking zone. Tower 9 is merely a fractionating tower and there is no statement or inference that the vapors or oil introduced thereinto are subjected to cracking conditions. The attempted combination of Dubbs patent with Barbet merely serves to produce an entirely different arrangement which was never contemplated by either of the patentees. Claim 13 in its amended form is believed to be clearly allowable. Claim 33 was also rejected on the same combination of references as claim 13, but as pointed out above, the combination of the system is not suggested in these patents.

Claims 16, 17 and 24 were rejected on Dubbs No. 1,799,413 in view of Hanna. The Examiner will note however, that Dubbs does not disclose the maintenance of an enlarged

body of liquid oil in an unheated vapor separating chamber or the withdrawal of carbon and tar from any element of apparatus corresponding to the separating chamber. These claims are process claims, and are not anticipated by a patent which discloses anything more than an apparatus.
164 Even the apparatus disclosed by Dubbs would have to be modified very substantially before it could be made to carry out the process defined by these claims.

Claim 24 was also rejected on Dubbs patent No. 1,534,927 in view of Jenkins. Dubbs not only fails to disclose the pressure reduction specified by this claim, but also fails to disclose the maintenance of a body of liquid oil at the cracking temperature as pointed out above. The Jenkins' patent does not disclose that it would be any advantage to maintain the Dubbs chamber K^3 at a lower pressure than that maintained in chamber K'. The stills of Jenkins are heated *cracking* stills, whereas the Dubbs chambers are not used for cracking oil. Claim 24 in its amended form is therefore believed to be allowable.

A new claim 49 has been added to more specifically cover the subject-matter defined by claim 17. This claim is believed to be allowable for the reasons discussed above in connection with claim 17 and for the further reason that it also includes a limitation with respect to the passage of inert gas into contact with the unvaporized oil constituents discharged into chamber 36. As pointed out in the specification this gas aids in the vaporization of the lighter portions of the oil constituents in this chamber.

Favorable consideration of the foregoing discussion of the claims in connection with the references, is requested.

In certain of the rejections made in the Office Action of November 25th, 1932, it appears that the Examiner has treated the claims involved in Interference No. 58,781 and No. 55,948, as prior art with respect to certain claims now being maintained in this application. The applicant knows of no authority for such a holding, particularly where the present applicant is senior and prior to any of the parties involved in those interferences.
165 The issue in Interference No. 55,948 was a very specific and limited issue and none of the adverse parties has attempted to adopt the broader claims of the present application.

Applicant is preparing to file a showing to prove that in the actual operation of his process as claimed, distillate oil and reflux condensate are actually pumped to the cracking coil from the cracking chamber. It was expected that this showing would be ready to file with this amendment but it will be filed as soon as possible, and before the case will normally be acted upon by the Examiner.

This amendment is believed to place the application in condition for allowance, and it is respectfully submitted that the Examiner is fully warranted in view of the facts being presented, to allow the claims.

Respectfully submitted,

EDMUND G. BORDEN
Attorney for Applicant.

New York, N. Y.
April 2nd, 1934.

201 Mailed Feb 19 1935

Div. 31 Room 4716 260 P-A Paper No. 23

Department of Commerce

United States Patent Office

Washington

Address only
"The Commissioner of Patents,
Washington, D. C.,"
and not any official by name

All communications
respecting this
application should give
the serial number,
date of filing, and
name of the applicant

Please find below a communication from the Examiner in charge of this application.

CONWAY P. COE,
Commissioner of Patents.

Applicant: Henry L. Doherty
Ser. No. 333,650
Filed Jan. 19, 1929
For Process of Distilling Oils

Edmund G. Borden,
60 Wall Street,
New York, New York.

Reference made of record:
Taveau 1,936,735 Nov. 28, 1933 196-66

Application No. 547,945 with which applicant was involved in Interference No. 58,781 has matured into the patent cited above.

Attention is called to the fact that "45-47" in lines 3 and 17 on page 1 of the Office action dated July 27, 1934 should read "45-48"; that is, claim 48 is included in the rejections set forth on this page.

Claims 1-5 inclusive, 8, 12, 13, 15, 16, 17, 22, 24, 33, and 45-49 inclusive are rejected for reasons of record except that in view of the petition granted by the Commissioner on January 7, 1935 which states that the Examiner may consider the question regarding the return of reflux from 36 to the coil 54, this question has been considered, and the rejection on the ground that applicant disclosed no process performing this function is withdrawn.

Claims 2, 4, 12, 13, 15, 16, 17, 22, 24, 45, 46, 47 and 48 are rejected as covering vapor phase cracking. These claims are so drawn that they include vapor phase cracking. The Examiner of Interferences and the Board of Appeals in Interference No. 58,781 held that applicant did not disclose vapor phase cracking and hence applicant is not entitled to any claim which includes this feature. Moreover, since the lack of vapor phase cracking was a ground on which
applicant was denied certain proposed counts in In-
202 terference No. 58,781, it is thought that applicant is
not entitled to claims broad enough to include this
feature. Claim 17 calls broadly for a distilling temperature and claim 49 for a temperature in excess of that required for vaporization of a substantial portion of the oil which are broader than cracking and include vapor phase cracking, which is not part of applicant's invention.

Claims 1-5 inclusive, 8, 12, 13 and 45-48 inclusive are rejected on the ground of estoppel arising under Rule 109. Since applicant did not present these claims at the time of Interference No. 58,781, he is now estopped to urge them. See the decision of the Board of Appeals in application to Brandt, Serial No. 532,953 (owned by the assignee of this case) line 13, page 7 to line 18, page 9. These claims read on the patent to Taveau who was the winning party in the interference. In regard to claims 1, 3, 12 and 13, Taveau shows a preheater at 52 where oil is heated under pressure and wherein portions of the oil are vaporized. Both vapors and unvaporized oil are heated to a cracking temperature in coil 45.

Claim 38 stands allowed.

Claims 6, 7, 9, 10, 11, 14, 18-21 inclusive, 23, 25-32 inclusive, 34-37 inclusive and 39-44 inclusive have been canceled.

Claims 1-5 inclusive, 8, 12, 13, 15, 16, 17, 22, 24, 33 and 45-49 inclusive are finally rejected.

203 Since the rejections set forth in this action are amplifications of the rejections previously made and outstanding in this application this action is made *Final.* The question of vapor phase cracking has been treated by the Board of Appeals, and the rejection on the ground of estoppel was first made in the Office action dated Nov. 25, 1932, Paper No. 9, and repeated in every subsequent action. Attention is called to the fact that this application has now been pending in this Office for more than six years.

C. S. DUNCOMBE,
Act. Examiner.

204 Paper No. 24 Jun-4 1935 Division 31
Application Div U. S. Patent Office June-3 35

Div. 31 Room 4716 Paper No. 24

In the United States Patent Office

Application: Henry L. Doherty
Serial No. 333,650 Filed Jan. 19, 1929
For: Process of Distilling Oils
Hon. Commissioner of Patents,
Washington, D. C.

Sir:

In the matter of the above entitled application and in response to the Office Action of February 19th, 1935, kindly enter the following amendments for purposes of appeal and for the purpose of expediting the prosecution of this application.

Claim 49, line 10, before the *comma* insert—while maintaining the same at a cracking temperature—

Enter the following claims:

—50. A process of distilling oil, comprising passing a stream of hydrocarbon oil through a heating zone under a superatmospheric pressure, vaporizing portions of said oil in said zone and heating the vapors, and unvaporized oil to a high temperature sufficient to crack the same, preheating fresh oil and introducing it into a cracking zone where a body of oil is retained, introducing said highly heated vapors while at a cracking temperature into direct contact with the body of oil in said cracking zone, whereby the oil of said body is heated to a cracking temperature and portions thereof converted into lower boiling products, subjecting the resulting vapors to reflux condensation and returning portions of the heavier condensate to said heating zone to be further cracked.—

205 —51. A process of distilling oil, comprising passing a mixture of heavy reflux condensate and other oil to be cracked in a stream through a heating zone, vaporizing oil of said stream in said zone and heating the resulting vapors to a temperature sufficient to crack the same, passing the vapors while hot into a body of oil in a cracking zone to heat the oil and convert portions thereof into lower boiling products, subjecting the vapors produced in both said zones to reflux condensation to separate higher boiling constituents, and condensing and collecting the desired low boiling products.—

—52. A process of cracking high boiling oils, comprising passing heavy condensate in a stream through a heating zone, vaporizing oil of said stream in said zone and heating the resulting vapors to a temperature sufficient to effect cracking thereof, cracking heavy oil in a liquid body of oil maintained in a cracking chamber, passing the vapors from said zone and chamber into a vapor fractionating zone, and condensing out the heavier constituents of said vapors to provide heavy condensate for said heating zone.—

—53. The process of converting high boiling hydrocarbon oils into lower boiling products which comprises passing the oil through a converter maintained at a sufficient cracking pressure and temperature to convert the oil in the vapor phase, maintaining a body of oil under pressure in an unheated still, delivering the products from the converter into the body of oil in the still whereby said oil is maintained at a cracking temperature and the oil converted in the liquid phase, separating out the lighter constituents of the evolved vapors and returning the heavier constituents thereof to the converter for retreatment.—

206 —54. A process of cracking heavier hydrocarbons to produce lighter hydrocarbons which consists in internally heating an externally unheated body of heavy hydrocarbons in liquid-phase to a cracking temperature under pressure and distilling the cracked hydrocarbons therefrom, condensing the heavier vapors of the hydrocarbons and heating the condensate from the heavier vapors to a cracking temperature to vaporize and crack the same, injecting the cracked vapors into said body of hydrocarbons and separately condensing the lighter vapors from said body.—

—55. The combined process for cracking oils in liquid and vapor phase, which comprises introducing a stream of oil containing reflux condensate derived from the process into a cracking zone in which the oil is heated to a temperature sufficient to vaporize and crack portions thereof in the vapor phase, conducting the hot vapor products from said zone into a body of oil maintained in a second cracking zone, intimately contacting said hot vapor products with the oil of said body whereby portions thereof are cracked in liquid phase, and subjecting the combined vapors produced from the cracking operations to reflux condensation.—

—56. The combined process of cracking relatively high boiling point oils in liquid and vapor phase into oils of lower boiling point, which comprises subjecting a distillate oil to cracking conditions of temperature and pressure in a zone in which portions of said distillate are cracked in vapor phase, conducting the resulting highly heated vapor products into a second cracking zone in which a body of oil is maintained under cracking conditions of temperature and pressure, intimately contacting said highly heated vapors with the oil of said body to thereby heat and crack portions thereof in liquid phase, and subjecting the vapors
207 from both cracking operations to fractional condensation to separate the desired low boiling point constituents from the higher boiling point constituents.—

Remarks

Claims 50 to 56 presented by this amendment are respectively proposed counts 2, 3, 4, 5, 9, 14 and 15 presented by the applicant in a Motion to Amend in Interference No. 58,781, and correspond respectively to claims 1, 2, 3, 5, 11 (compare 46), 43 (compare 47), and 44 (compare 48), without amendments. These claims are presented for purposes of appeal in view of the fact that the Examiner has apparently changed his position and rejected claims 1 to 5, 8, 12, 13 and 45 to 48 on the grounds of estoppel arising under Rule 109. It has always been the applicant's intention, as clearly shown by the record, to preserve in the application suitable claims covering subject-matter considered on Motion to Amend in Interference No. 58,781. Until the Office Action of February 19th, 1935, the Examiner has always considered the amendments to claims presented by applicant's motion in Interference No. 58,781, not to involve a patentable difference over the claims as originally worded (See the last paragraph, page 2, of the Office Action of July 27th, 1934). The applicant therefore respectfully requests entry of the present amendment for purposes of appeal because he believes that he is clearly entitled to the subject-matter of these claims and that there should be no estoppel. Certainly the applicant has done everything in his power
to avoid the application of any doctrine of estoppel.

208 Technically the Office Action of February 19th,
1935 is not a final rejection, but the applicant is willing to regard it as such provided the present amendment is entered. The Examiner will note that the rejection of claims 2, 4, 12, etc., as made in the last paragraph, page 1 of the Office Action, is an entirely new ground of rejection. In the Office Action of February 19th, 1935 the Examiner states in the paragraph on page 3, that the rejection on the ground of estoppel under Rule 109 (at page 2) is not a new ground of rejection, whereas, as a matter of fact it was made for the first time in this Office Action. Counsel for the applicant has carefully reviewed all of the Office Actions in this case, including the Office Action of November 25th, 1932 (Paper No. 9), and fails to find any rejection on the ground of estoppel under Rule 109 in any Office Action except the last. The term "estoppel" is used at the top of page 2 of the Office Action of November 25th, 1932, but

it obviously refers to a question of res adjudicata based upon the rejections used by the Examiner of Interferences and the Board of Appeals. The Marconi case cited by the Examiner obviously supports this interpretation. The Examiner certainly must know that there could be no estoppel under Rule 109 with respect to the identical claims presented by an applicant on a Motion to Amend so that it is impossible to imply such a rejection into the office Action of November 25th, 1932.

Claim 49 has been amended to more definitely point out the idea that the oil heated in the restricted stream is maintained at a cracking temperature during the passage of inert gas in contact therewith. The Examiner will note that this claim calls for the vaporization of a substantial proportion of the oil heated in the restricted stream which
209 is not true of the Dubbs patent No. 1,534,927 relied upon by the Examiner. Furthermore the patent does not disclose the cracking of oil in the chamber K′. The patentee Dubbs has taken out an alleged divisional patent (#1,684,654) which specifically claims the liquid phase cracking in the coil (tubes B) and the cooling of the oil discharged from the coil by the introduction of cold charging stock from the pump J. A patent cannot be regarded as a disclosure of two entirely opposite processes and therefore the rejection of claim 49 on this patent should be waived.

The applicant respectfully requests that this amendment be entered for purposes of appeal. Regardless of whether or not the Examiner cites new art against any of the claims numbered 50 to 56, the applicant elects to continue the case before the Board of Appeals. These claims have previously been found patentable by the Examiner of Interferences and the Board of Appeals. An appeal is being filed from the final rejection of February 19th, 1935 in order to expedite the determination of the matters involved.

Respectfully submitted,

EDMUND G. BORDEN
Attorney for Applicant

New York, N. Y.
April 17, 1935

210 Paper No. 26 June-6 1935 Division 31
Mail Division U. S. Patent Office Jun 3 1935
Board of Appeals U. S. Patent Office June 4 1935

In the United States Patent Office

Application: Henry L. Doherty
Serial No. 333,650 Filed Jan. 19, 1929
For: Process of Distilling Oils

Appeal to the Board of Appeals

The applicant through his attorney hereby appeals to the Honorable Board of Appeals from the action of the Primary Examiner, dated February 19th, 1935, by which he finally rejected claims 1 to 5, 8, 12, 13, 15, 16, 17, 22, 24, 33 and 45 to 49.

The reasons for the appeal are as follows:

1. That the Examiner erred in rejecting the above-mentioned claims for the reasons of record as stated in the middle paragraph, page 1 of the Office Action of February 19th, 1935;

2. That the Examiner erred in rejecting claims 2, 4, 12, 13, 15, 16, 17, 22, 24 and 45 to 48 on the ground that they cover vapor phase cracking;

3. That the Examiner erred in rejecting claims 1 to 5, 8, 12, 13 and 45 to 48 on the grounds of estoppel under Rule 109 for failure to present these claims in Interference No. 58,781;

4. That the Examiner erred in rejecting claims 50 to 56 (held patentable over the prior art by the Board of Appeals) on the ground that they are not supported by the applicant's disclosure and on the further ground that they are unpatentable over certain prior art patents;

5. That the Examiner erred as to matters of fact and matters of law in his rejections of the above-mentioned claim.

6. That the Examiner erred in finally rejecting the
211 application.

The appeal fee of $15 is being filed herewith.

Respectfuly submitted,

EDMUND G. BORDEN
Attorney for Applicant

New York, N. Y.
April 17, 1935

212 Mailed Sep 6 1935

Paper No. 26

Department of Commerce

United States Patent Office

Washington

On Appeal to the Board of Appeals

In re application Henry L. Doherty Ser. No. 333,650
Filed Jan. 19, 1929 For: Process of Distilling Oils

Examiner's Statement

This is an appeal from the action of the Primary Examiner in finally rejecting claims 1-5 inclusive, 8, 12, 13, 15, 16, 17, 22, 24, 33 and 45-49 inclusive.

Claims 50-56 inclusive have been presented after the final rejection to submit certain subject matter in better form for appeal.

Claim 38 has been allowed.

Claims 6, 7, 9, 10, 11, 14, 18-21 inclusive, 23, 25-32 inclusive, 34-37 inclusive and 39-44 inclusive have been cancelled.

The appealed claims are as follows:

Claim 1. A continuous process of distilling oil, comprising passing a stream of hydrocarbon oil through a heating zone under a superatmospheric pressure, vaporizing portions of said oil in said zone and heating the resulting vapors, and unvaporized oil of said stream to a high temperature sufficient to crack (a substantial portion of the same, preheating fresh oil and introducing it into an unheated cracking zone in which an enlarged body of liquid oil is retained, introducing said highly heated vapors while at a cracking temperature into direct contact with the body of oil in said cracking zone, whereby the oil of said body is heated to a cracking temperature and portions thereof converted into lower boiling products, subjecting the resulting vapors to reflux condensation and returning portions of the heavier condensate to said heating zone to be further subjected to the cracking conditions maintained therein.

213 Claim 2. A continuous process of distilling oil and cracking oil for the production of gasoline, comprising passing a mixture of heavy reflux condensate and other

oil to be cracked in a stream through a heating zone, vaporizing oil of said stream in said zone and heating the oil constituents therein to a temperature sufficient to crack the same passing the highly heated oil constituents from said zone and passing the vapors thereof while hot into an enlarged body of oil in an unheated cracking zone to heat the oil and convert portions thereof into lower boiling products, subjecting the vapors produced in both said zones to reflux condensation to separate higher boiling constituents, and condensing and collecting the desired low boiling products.

Claim 3. A process of cracking high boiling oils, comprising continuously passing heavy condensate in a stream through a heating zone, vaporizing oil of said stream in said zone and heating the resulting vapors and any unvaporized oil constituents present therein while passing through said zone to a temperature sufficient to effect cracking thereof, cracking heavy oil in an enlarged liquid body of oil maintained at a cracking temperature in a cracking chamber to which no extraneous heat is applied, passing the vapors from said zone and chamber into a vapor fractionating zone, and condensing out the heavier constituents of said vapors to provide heavy condensate for said heating zone.

Claim 4. A continuous process of distilling and converting high boiling hydrocarbon oils, comprising passing fresh charging stock into heat exchange with vapors in a partial condensing zone to preheat said oil and form a condensate comprising the heavier components of said vapors, passing the charging stock from said zone directly to an externally unheated still in which an enlarged body of oil is maintained at a cracking temperature and from which vapors are conducted to said zone, continuously passing portions of said condensate through a cracking coil where they are heated to a cracking temperature, and then passing the heated products into said still into direct contact with the body of oil therein to supply the entire heat necessary for cracking the oil of said body.

Claim 5. The process of converting high boiling hydrocarbon oils into lower boiling gasoline-like products, which comprises continuously passing a stream of the oil through a converter maintained at a sufficient cracking pressure and temperature to convert a portion of the oil in the vapor phase, maintaining an enlarged body of oil under pressure in an unheated still, introducing fresh charging stock into said still, delivering the products from the converter into the body of oil in the still whereby said oil is maintained at a cracking temperature and the oil converted in the liquid phase, separating out the lighter constituents of the evolved vapors and returning at least a portion of the heavier constituents thereof to the converter for retreatment.

214 Claim 8. The process of converting high boiling hydrocarbon oils into lower boiling gasoline-like products which comprises delivering a heavy oil to an unheated still to supply an initial body of oil thereto, delivering oil including at least in part a suitable distillate continuously to a cracking coil where at least a portion thereof is cracked in the vapor phase at high cracking temperatures and pressures, discharging the evolved vapors into the body of oil in the still to maintain said body at a sufficient cracking temperature and pressure to effect the cracking of the oil in the liquid phase, taking off the evolved vapors, supplying a heavy oil to the still, preheating it by the evolved vapors taken therefrom, separating out the lighter constituents of the evolved vapors and returning at least a portion of the heavier constituents to the cracking coil to replace, in whole or in part, the oil initially supplied thereto.

Claim 12. A process of converting oil, comprising passing oil in a continuous stream through a heating zone to vaporize portions of the oil, heating the vapors and unvaporized oil in said zone to a temperature sufficient to effect cracking thereof, passing the resulting products into an enlarged chamber, maintaining an enlarged body of liquid oil in an unheated cracking zone under cracking conditions of temperature and pressure, preheating fresh charging stock and introducing it into said body, and passing vapor and liquid products from said chamber into said cracking zone in contact with the body of oil therein thereby to maintain the body of liquid oil at a cracking temperature.

Claim 13. The process of cracking heavy hydrocarbon oils for the production of gasoline, which comprises maintaining a liquid body of heavy oil in an unheated cracking zone under cracking conditions of temperature and pressure, continuously introducing oil into a heating zone where portions of the oil are vaporized and the resulting vapors and unvaporized oil are heated to a cracking temperature, passing the heated products from said heating zone into an enlarged chamber for further cracking, and passing the vapors from said chamber into the body of oil in said cracking zone to maintain a cracking temperature for the oil therein.

Claim 15. The process of cracking oils, which comprises passing oil from a supply chamber through a heating zone to a separating chamber, heating the oil to a cracking temperature in its passage through said zone, separating carbon and tarry matter from a mixture of oil, carbon and tarry matter in the separating zone and withdrawing the carbon and tarry matter, passing the clarified oil to the supply chamber, removing and collecting the vapors liberated in the said chambers, and introducing fresh oil into the supply chamber.

Claim 16. The process of cracking petroleum oils,
215 which comprises passing oil to be cracked through a heating zone where the oil is heated to a cracking temperature, delivering the heated oil into an unheated vapor separating zone in which an enlarged body of oil is maintained at a cracking temperature and where carbon and tar is separated from oil with which it is mixed, withdrawing the carbon and tar from said zone, passing vapors from said zone in heat exchange with charging oil in a reflux condenser, passing reflux condensate and charging stock from said condenser and clarified tar-and-carbon-free oil from said separating zone into an enlarged chamber, and passing oil from said chamber into said heating zone.

Claim 17. A process of distilling oils, comprising passing oil through a heating zine whereby the oil is brought to a distilling temperature, introducing the heated oil into a separating chamber, effecting a separation of residual matter from oil in said separating chamber, withdrawing the residual matter from the system, passing the clarified oil into a second enlarged zone, passing vapors evolved in said chamber and enlarged zone into a reflux condensing zone, introducing the oil to be distilled into the vapors in said refluxing zone, passing the introduced oil and reflux condensate into said second enlarged zone to mix with the oil from said separating chamber, and passing the resulting mixture through said heating zone.

Claim 22. The process of cracking petroleum oil, which comprises heating oil to be cracked to a cracking temperature while passing it in a stream through a heating zone, passing the heated oil into a large reaction zone where conversion occurs, separately removing vapors and unvaporized oil from said reaction zone and introducing the same into a zone maintained under a lower pressure, and subjecting the combined vapors from said zones to reflux condensation in heat exchange with charging stock for the process.

Claim 24. The process of cracking heavy hydrocarbons to form lower boiling gasoline products, which comprises continuously passing oil from an enlarged body of oil maintained in a still in a stream of restricted cross section through a heating zone where the oil is raised to a high cracking temperature, delivering the highly heated oil from said zone into an enlarged vapor separating zone where a body of oil is maintained at a cracking temperature, passing vapors from said zone to a reflux condenser where a reflux condensate is formed therefrom, passing said condensate into said still, and maintaining a substantially higher pressure on the oil in said zones than that maintained in said still.

216 Claim 33. An apparatus for producing relatively low boiling point oils, comprising means including a long coil for heating oil to cracking temperature while passing therethrough at relatively high speed, an unheated cracking chamber, means for delivering oil at cracking temperature from said heating means to the upper portion of said cracking chamber, and means for delivering vapor from said heating means to the lower portion of said chamber.

Claim 45. A process of converting high boiling hydrocarbon oils into lower boiling gasoline-like products, which comprises continuously delivering oil to be cracked including a suitable high boiling distillate to a highly heated converter in which vaporization and cracking of portions of the oil occurs, continuously delivering a heavy fresh oil charging stock to an unheated still and maintaining an enlarged body of oil therein, delivering the evolved vapors from the oil heated in the converter into the body of oil in the still thereby to heat said oil and maintain the same at a cracking temperature sufficient for liquid phase cracking, removing from the still the evolved vapors of both cracking portions, separating out the lighter constituents thereof and continuously returning at least a portion of the heavier constituents to the converter to supply oil to be cracked therein.

Claim 46. A continuous process for cracking heavier hydrocarbons to produce lighter gasoline-like hydrocarbons, which consists in internally heating an externally unheated body of heavy hydrocarbons in liquid phase to cracking temperature under superatmospheric pressure and distilling portions of the hydrocarbon including the relatively low boiling point cracked hydrocarbons therefrom, introducing fresh charging stock to said body of hydrocarbons, condensing the heavier vapors of the distilled and vaporized hydrocarbons, heating at least a portion of the condensate from the heavier vapors to a cracking temperature while passing in a continuous stream of restricted cross section through a heating zone in which vaporization occurs, injecting the resulting cracked vapors into intimate contact with the hydrocarbons of said body, and separately condensing the lighter vapors removed from said body.

Claim 47. The combined process for cracking oils to produce gasoline, which comprises continuously passing a restricted stream of oil containing reflux condensate derived from the process through a heating and cracking zone in which the oil is heated to a temperature sufficient to vaporize portions thereof and to crack a substantial portion of the oil constituents passing therethrough, conducting the resulting hot vapor products from said cracking zone into an enlarged body of oil maintained in a second externally unheated cracking zone, intimately contacting said hot vapor products with the oil of said body whereby portions thereof are cracked to lower boiling point gasoline-like products, introducing charging oil into said second zone, and subjecting the combined vapors produced from the cracking operations to reflux condensation.

217 Claim 48. The combined process of cracking relatively high boiling point oils into oils of lower boiling point for the production of cracked gasoline, which comprises continuously passing a distillate oil in a confined stream of restricted cross section through a heat-

ing zone in which the distillate oil is subjected to cracking conditions of temperature and pressure and in which zone portions of said distillate are vaporized, conducting the resulting highly heated vapor products into a second cracking zone to which no outside heat is supplied and in which an enlarged body of oil is maintained under cracking conditions of temperature and pressure, intimately contacting said highly heated vapors with the oil of said body to thereby heat and crack portions thereof, and subjecting the vapors from both cracking zones to fractional condensation to separate the desired low boiling point gasoline constituents from the higher boiling point constituents.

Claim 49. A process for distilling petroleum oils, comprising passing a continuous stream of oil of restricted cross section through a heating zone wherein the oil is heated at a superatmospheric pressure to a temperature in excess of that required to vaporize substantial proportions of the oil, introducing the stream of highly heated oil into a separating zone in which unvaporized oil constituents are separated from oil vapors, passing an inert gas in intimate contact with the separated unvaporized oil constituents resulting from said heating while maintaining the same at a cracking temperature, passing the separated vapors together with the gas passed in contact with said unvaporized oil constituents through a series of vapor fractionating zones in which the vapors are subjected to successively lower temperatures and in which fractions of the vapors are condensed and separately removed, and finally separating the inert gaseous constituents from lower boiling condensible hydrocarbons.

Claim 50. A process of distilling oil, comprising passing a stream of hydrocarbon oil through a heating zone under a superatmospheric pressure, vaporizing portions of said oil in said zone and heating the vapors, and unvaporized oil to a high temperature sufficient to crack the same, preheating fresh oil and introducing it into a cracking zone where a body of oil is retained, introducing said highly heated vapors while at a cracking temperature into direct contact with the body of oil in said cracking zone, whereby the oil of said body is heated to a cracking temperature and portions thereof converted into lower boiling products, subjecting the resulting vapors to reflux condensation and returning portions of the heavier condensate to said heating zone to be further cracked.

Claim 51. A process of distilling oil, comprising
218 passing a mixture of heavy reflux condensate and other oil to be cracked in a stream through a heating zone, vaporizing oil of said stream in said zone and heating the resulting vapors to a temperature sufficient to crack the same, passing the vapors while hot into a body of oil in a cracking zone to heat the oil and convert portions thereof into lower boiling products, subjecting the vapors produced in both said zones to reflux condensation to separate higher boiling constituents, and condensing and collecting the desired low boiling products.

Claim 52. A process of cracking high boiling oils, comprising passing heavy condensate in a stream through a heating zone, vaporizing oil of said stream in said zone and heating the resulting vapors to a temperature sufficient to effect cracking thereof, cracking heavy oil in a liquid body of oil maintained in a cracking chamber, passing the vapors from said zone and chamber into a vapor fractionating zone, and condensing out the heavier constituents of said vapors to provide heavy condensate for said heating zone.

Claim 53. The process of converting high boiling hydrocarbon oils into lower boiling products which comprises passing the oil through a converter maintained at a sufficient cracking pressure and temperature to convert the oil in the vapor phase, maintaining a body of oil under pressure in an unheated still, delivering the products from the converter into the body of oil in the still whereby said oil is maintained at a cracking temperature and the oil converted in the liquid phase, separating out the lighter constituents of the evolved vapors and returning the heavier constituents thereof to the converter for retreatment.

Claim 54. A process of cracking heavier hydrocarbons to produce lighter hydrocarbons which consists in internally heating an externally unheated body of heavy hydrocarbons in liquid-phase to a cracking temperature under pressure and distilling the cracked hydrocarbons therefrom, condensing the heavier vapors of the hydrocarbons and heating the condensate from the heavier vapors to a cracking temperature to vaporize and crack the same, injecting the cracked vapors into said body of hydrocarbons and separately condensing the lighter vapors from said body.

Claim 55. The combined process for cracking oils in liquid and vapor phase, which comprises introducing a stream of oil containing reflux condensate derived from the process into a cracking zone in which the oil is heated to a temperature sufficient to vaporize the crack portions thereof in the vapor phase, conducting the hot vapor products from said zone into a body of oil maintained in a second cracking zone, intimately contacting said hot vapor products with the oil of said body whereby portions thereof are cracked in liquid phase, and subjecting the combined vapors produced from the cracking operations to reflux condensation.

219 Claim 56. The combined process of cracking relatively high boiling point oils in liquid and vapor phase into oils of lower boiling point, which comprises subjecting a distillate oil to cracking conditions of temperature and pressure in a zone in which portions of said distillate are cracked in vapor phase, conducting the resulting highly heated vapor products into a second cracking zone in which a body of oil is maintained under cracking conditions of temperature and pressure, intimately contacting said highly heated vapors with the oil of said body to thereby heat and crack portions thereof in liquid phase, and subjecting the vapors from both cracking operations to fractional condensation to separate the desired low boiling point constituents from the higher boiling point constituents.

The references are:

Rosenbaum 1,324,983 Dec. 16, 1919 196-48
Setzler 1,449,452 March 27, 1923 196-134 xr
Alexander 1,407,619 Feb. 21, 1922 196-48
Behimer Re 16,877 Feb. 14, 1928 196-58
Von Groeling 1,295,088 Feb. 18, 1919 196-59 xr
Dubbs 1,534,927 April 21, 1925 196-48
Knox 1,428,641 Sept. 12, 1922 196-48
Cosden et al 1,261,215 Apr. 2, 1918 196-48
Trumble 1,281,884 Oct. 15, 1918 196-59
Sherman 1,260,584 Mar. 26, 1918 196-48
Burton et al 1,448,254 Mar. 13, 1923 196-59 xr

Hanna 1,408,698 Mar. 7, 1922 196-59
Biddison et al 1,345,740 July 6, 1920 196-66
Dubbs 1,525,281 Feb. 3, 1925 196-48 xr
Barbet 836,732 Nov. 27, 1906 196-106 xr
Dubbs 1,799,413 April 7, 1931 196-108
Interference No. 58,781 (consolidated with Interference No. 55,948)
Taveau 1,936,735 Nov. 28, 1933 196-66
Taveau is the winning party in Int. No. 58,781

This application discloses a process for cracking hydrocarbon oils. Feed oil introduced at 10 after having been preheated by indirect heat exchange in passing through a series of condensers 16-30 is passed via line 34 into cracking chamber 36. In heating coil 54 oil is heated under pressure to a cracking temperature disclosed as 600-900° F. This heated oil is delivered through line 60 into separator
62 where the vapors separate from the liquids.
220 The vapors are passed through lines 64 and 48 to
the lower part of cracking chamber 36, while the liquids are passed into settling chamber 112 where carbon and tarry matter settles out and clarified oil is passed to a higher part of 36 through lines 66 and 44. With this arrangement the heated vapors pass through cracking chamber 36 in countercurrent to the feed oil having been introduced through line 34 and the heated liquids entering through line 44. The heated vapors entering cracking chamber 36 through line 44 and the heated liquids entering through line 48 supply the heat for the cracking taking place in 36. The pressure in cracking chamber 36 is reduced with respect to separating chamber 62 (last paragraph on page 15). The vapors pass up through cracking zone 36 into reflux condenser 70 and those vapors not therein condensed are passed through condensers 30-16 in indirect heat exchange with the feed oil. Reflux condensate from 70 is returned to the upper part of cracking zone 36 and some of it passes downwardly with the feed oil through cracking chamber 36. Unvaporized oil is withdrawn from cracking chamber 36 through line 46 and passed via line 52 to heating coil 54.

The cracking chamber 36 contains a series of superposed trays or horizontal portion 38 having liquid overflow pipes 40 and perforations sufficiently small to permit the passage therethrough of upgoing vapors but not the passage of liquid. The liquid then collects on each tray to a depth determined by the height of each overflow pipe 40 and the vapors bubble up in direct heat exchange with the liquid oil body collected on each tray.

221 A gas which may be "inert gases" among which air is disclosed (last paragraph page 2) may be passed into line 52 from line 56 to increase the velocity with which the oil passes through heating coil 54.

The patent to Taveau, who is the winning party in Int. No. 58,781, discloses a process for cracking hydrocarbon oils. Charge oil introduced at 40 is preheated at 12 and introduced into still 10 through line 38. A lighter oil and a reflux condensate from fractionator 16 are preheated in 52 and heated in converter 14 to a vapor phase cracking temperature 500-600° C. (932-1112° F.). These hot vapors are discharged through line 34 into the body of oil in still 10. The heat of the vapors thus introduced is utilized to maintain the body of oil in 10 at a cracking temperature to effect conversion therein in the liquid phase. The vapors from 10 pass via 56 to fractionator 16, and reflux condensate from 16 is returned to converter 14.

The patent to Rosenbaum discloses a process for cracking hydrocarbon oils. Charge oil, which may be a crude oil, is poured into zone 1 where it is heated and vapors pass to dephlegmator D. Reflux condensates are returned from D and are heated in coil 27 under pressure and a temperature considerably higher than the normal boiling temperature. The temperature disclosed is 500-850° F. This heated material is then discharged into zone 1 where the heat given to the material in coil 27 is effective in breaking up the heavier hydrocarbons into lighter hydrocarbons, that is, cracking takes place (page 1 lines 33-45).
222 This heated oil injected into zone 1 is also effective in cracking any oil within this zone, that is, the unvaporized charge oil remaining in zone 1 (page 1 lines 53-62 and page 3 lines 2-12). Thus in zone 1 is cracked a mixture of oil heated in 27 and the unvaporized charge oil in zone 1.

The patent to Setzler discloses a process for cracking a hydrocarbon oil. Feed oil is preheated by passing through coils g^1 and g^{11} in c and d respectively. This preheated oil is passed through line g^{111} into cracking zone "a" where it is cracked in admixture with reflux condensate from reflux dome d.

The patent to Alexander discloses a process for cracking a hydrocarbon oil. In coil 75 of Fig. 5 oil is heated and vaporized and the vaporized oil passed to cracking zone 82 (page 5 lines 97-114).

The patent to Behimer discloses a process for cracking hydrocarbon oils. The oils heated in coil 1 may be vaporized or not therein as per page 3, lines 21-38. The heated oil is then delivered in zone 11 where cracking takes place.

The patent to Dubbs No. 1,534,927 discloses a process for cracking hydrocarbon oils. A hydrocarbon oil is heated in B to a cracking temperature which may be 850° F. (page 4 line 1), and the heated products delivered in tank K^1. Vapors pass through P to condensers Q and R and from Q a condensate is withdrawn at W and from R a condensate is collected in S. Steam may be injected into 223 line L of Dubbs at Y or Y^1 which mixes with the oil being cracked in B. It is to be noted that Dubbs states that at time pump J does not deliver charge oil to tank K^1. When this is the case, it is thought that there would be some cracking in K^1 of Dubbs in view of the fact that the oil in B may be heated to 850° F.

The patent to Von Groeling discloses a process for cracking hydrocarbon oils. The feed oil is introduced at y, passed through preliminary heater D, through y^1 to the jacket of dephlegmator C^1, through y^2 into the jacket of dephlegmator C, and after thus being preheated through y^3 to still B. In still B the oil passes over the baffles or sieves x^1, x^2, etc. and drips down into the bottom of the still. An oil is heated in A to a cracking temperature, and when the pressure in A becomes large enough to open valve b, heated oil is admitted into the bottom of still B through a, a^{iii} and a^{v}. The heat in this oil effects cracking in still B of the oil therein (page 4 lines 40-64). Reflux condensate from C is returned to B through line d.

The patent to Knox discloses a process for cracking hydrocarbon oils in which an oil from tank 7 and condensate from 52 are heated and vaporized in 19 and 21, the vapors are heated and cracked in vapor phase in 25, and the heated vapors are passed through 24 and are then contacted in 23 with oil which has been preheated in 19 and 21 by the vapors coming from the cracking zone.

224 The patent to Cosden et al discloses a process for cracking a hydrocarbon oil. In 1 a hydrocarbon oil is heated to a cracking temperature and the superheated vapors pass through line 3 into cracking chamber 4. A feed oil is introduced into 4 through line 15 and spray 13, and this oil is cracked by the heat imparted by the superheated vapors entering through line 3. The unvaporized oil in 4 and reflux condensates from 4, 6 and 8 may be returned to heating zone 1 through lines 28, 29 and 30.

The patent to Trumble discloses a process for cracking a hydrocarbon oil in which the oil to be cracked is heated in a stream in a cracking coil 1. The oil is here partially vaporized and cracked (page 4 lines 73-100).

The patent to Sherman discloses a process for cracking hydrocarbon oils. Feed oil, which may be a crude oil, is placed into still 1 and heated. Condensates are withdrawn from tower 4 and passed through lines 5 and 6 into coil 7 immersed in a lead bath 10 at the bottom of the still where the highest temperature obtains. In coil 7 the condensates are vaporized and cracked (page 2 lines 47-60) and are then discharged into the space above the liquid oil 9 in still 1, while the liquid oil is also being cracked (page 2 lines 71-88). The temperature in coil 7 is disclosed as 650-850° F. (page 2 lines 9-13).

225 The patent to Burton et al discloses a process for cracking hydrocarbon oils in which a feed oil is charged at 24 and passed downwardly through line 16 in heat exchange with hot vapors passing upwardly in this line. The unvaporized oil and reflux condensate from 16 are discharged into still 10 where funnel 29 conveys the oil to 32 and heating tubes 10^1. The oil is heated in tubes 10^1 to a cracking temperature, and passed to still 10 where a cracking temperature prevails. The still 10 is not heated externally and the heat supplied to 10 is contained by the heated materials entering from tubes 10^1.

The patent to Hanna discloses a process for cracking hydrocarbon oils. A feed oil from 12 is passed through line 3 into vapor line 16 and passes downwardly in heat exchange relation with vapors in this line. The unvaporized oil and reflux condensate pass directly into evaporator 5 where they are received by pan 25 and then passed via 26, 27, 7 and 8 to cracking coil 9. The heated products are then discharged into still 5 through line 11. It is thought that some cracking would necessarily occur in evaporator 5 from the heat imparted by hot products entering at 11.

The patent to Biddison et al discloses that a body of oil is maintained in cracking zone 8. A hydrocarbon oil is heated, vaporized and cracked in 2 (page 1 lines 108-110) and vapor and liquid products pass into chamber 3 and then into cracking zone 8. Some of the unvaporized oil in cracking zone 8 may be passed to heating coil 2 via 10, 19, 23 and 6.

226 The patent to Barbet discloses cracking a hydrocarbon oil in 7. Vapors from 7 pass via line 10 to the lower part of dephlegmating column 9, while liquids pass from 7 to a higher part of column 9 through line 15 so that the liquids flow downwardly in countercurrent to the vapors moving upwardly.

The patent to Dubbs 1,525,281 discloses cracking an oil in a stream in coil B and passing it through line C into reaction zone D. Vapors are dephlegmated in countercurrent with charge oil introduced into the dephlegmator through line K.

In patent No. 1,799,413 to Dubbs cracked oil passes into separating zone B^2. Reflux condensate passes by S^1 to tanks C. Carbon and tar also pass to tanks C and are separated from the oil therein.

The patent to Jenkins discloses a series of cracking zones in which the pressure decreases progressively as the oil being cracked passes from zone to zone.

Claims 1, 3, 5, 8, 12, 13 and 46 are rejected as defining subject matter not disclosed by applicant. The Examiner of Interferences and the Board of Appeals in Int. No. 58,781 held that applicant did not disclose vapor phase cracking, and hence applicant is not entitled to any claim which requires this feature for the reasons given in that interference. (See Int. No. 58,781, Papers Nos. 32 and 45).

Claims 50-56 inclusive are proposed counts 2, 3, 4, 5, 9, 14 and 15 respectively presented by applicant in a Motion to Amend in Interference No. 58,781. These claims require vapor phase cracking and are rejected as defining

subject matter not disclosed by applicant for reasons set forth by the Examiner of Interferences and the Board of Appeals in that interference. Claims 53 and 54 are
227 claims 1 and 8, respectively, of the Taveau patent.

Claims 1-5 inclusive, 8, 12, 13 and 45-48 inclusive are rejected on the ground of estoppel arising under Rule 109. These claims read on Taveau the winning party in Int. No. 58,781, and since applicant did not present these claims under Rule 109, he is now estopped to urge them. Applicant has argued that he is not estopped in view of the amendment to Rule 116 made by Commissioner's Order No. 3281. But this interference was decided long before the effective date of this amendment, and hence this amendment to Rule 116 does not apply to this application. Attention is here called to the decision of the Board of Appeals in the application to Brandt, Serial No. 532,953 (owned by the same assignee as this case) page 7, line 13 to page 9, line 18 where this same point has been decided.

Claims 1, 4, 8, 13 and 50 are rejected as unpatentable over Rosenbaum in view of Seltzler or Knox. To preheat the charge oil passed into zone 1 of Rosenbaum as taught by Setzler or Knox lacks invention. The word "continuous" appearing in these claims is too vague to constitute a patentable distinction over these references since no process step differing from these references is set forth which necessarily makes the process a continuous one. Moreover, to continuously feed charge oil to zone 1 of Rosenbaum also lacks invention in view of Setzler. The cracking zone 1 of Rosenbaum is "unheated" in the same sense as applicant's since both teach heating the oil in the cracking zone by the heat of the oil having been heated in a coil. However, to eliminate the furnace under zone 1 of Rosenbaum even if definitely required by the claims lacks invention. Since the temperature of 850° F. disclosed by Ros-
228 enbaum (page 2 lines 95-100) falls within the range
of 600-900° F. disclosed by applicant, if applicant obtains vaporization and cracking of the vapors in the process of these claims so must Rosenbaum in coil 27.

Claims 1, 2, 45, 46, 47 and 48 are rejected as unpatentable over Cosden et al in view of Trumble. To substitute for the heater 1 of Cosden et al the cracking coil 1 of Trumble so that the oil would be heated, vaporized and cracked in a stream would not amount to invention. The word "continuous" appearing in these claims is not thought to set forth any process step with such definiteness as required by R. S. 4888 as to patentably distinguish from these references. The temperature at 3 of Cosden et al is 725° F. which is within the range of 600-900° F. disclosed by applicant, and hence if applicant cracks the vapors at this temperature so must Cosden et al.

Claims 2, 13, 45-48 inclusive and 51 are rejected as unpatentable over Knox in view of Cosden et al. To pass the heated vapors in line 24 of Knox *into* the oil in chamber 23 lacks invention in view of Cosden et al who teaches this feature in cracking chamber 4.

Claims 2, 3, 5, 13, 45-48 inclusive, 51, 52, 55 and 56 are rejected as unpatentable over Rosenbaum in view of Alexander. Rosenbaum cracks a condensate in coil 27 and injects it into the body of oil in zone 1 to crack the oil therein (page 3 lines 5-12). It is thought that some vaporization and cracking of the vapors would take place in coil 27 of Rosenbaum since 850° F. disclosed by him falls within the range of 600-900° F. disclosed by applicant. But even if this were not true to permit some vaporization to take place in this coil and to crack the vapors lacks invention because it is old as shown by Alexander and be-
229 cause no unexpected or novel results are due to this
feature in the process here claimed. The "other oil" in line 2 of claim 2 is too vague to patentably distinguish over the mixture of oils heated in 27 of Rosenbaum. In regard to claim 3, note that Rosenbaum states that vapors are cracked (page 1 lines 39-45). Rosenbaum discloses the positive step of heating cracking zone 1 by the heat of the oil heated in coil 27 which is the same process step of heating the cracking zone 36 of applicant, and therefore, to describe this zone as being "unheated" or a zone "to which no extraneous heat is applied" does not patentably distinguish from Rosenbaum. The word "continuously" in line 6 of claim 45 does not patentably distinguish from Rosenbaum since to supply feed oil continuously to zone 1 lacks invention since such a feature is well-known as shown by Dubbs 1,534,927, Biddison et al, Cosden et al and Alexander, and to apply this step to Ros-

enbaum would add only such results obviously to be expected from such a change.

Claims 2, 3, 5, 13, 45-48 inclusive, 51, 52, 55 and 56 are rejected as unpatentable over Rosenbaum in view of Behimer. It is thought that some vaporization would take place in coil 27 of Rosenbaum, but even if not to partially vaporize the oil in coil 27 lacks invention in view of Behimer.

Claims 3, 45-48 inclusive, 51, 52, 55 and 56 are rejected as unpatentable over Sherman. Since the vapors from coil 7 entering the space above the crude oil 9 are at a higher temperature than the crude oil, it is thought that they would give up some of their heat to the crude oil. Nevertheless, the expression "cracking chamber to which no extraneous heat is applied" is thought too in-
230 definite to constitute a patentable distinction over
this reference. Moreover, it is thought that the heat supplied to chamber 36 of applicant by the heated products in lines 44 and 48 might be considered "extraneous heat", for this heat comes from outside the chamber. The temperature range of 650-850° F. disclosed by Sherman falls within the range of 600-900° F. disclosed by applicant, and hence if applicant gets vapor phase cracking at this temperature so must Sherman in coil 7.

Claim 4 is rejected as unpatentable over Hanna or Burton et al. The heat supplied to zone 5 of Hanna and zone 10 of Burton et al which effects the cracking in these respective zones comes from the heated materials delivered to these zones.

Claims 4, 8 and 50 are rejected as unpatentable over Dubbs 1,534,927 in view of Von Groeling. To preheat the charge oil in Dubbs lacks invention in view of Von Groeling. Moreover, to heat the oil in A of Von Groeling in a cracking coil as shown at B by Dubbs would not amount to invention. Some of the oil in coil B of Dubbs would vaporize and the vapors be cracked as well as in the process of these claims since Dubbs discloses a temperature of 850° F. which is within the range of 600-900° F. disclosed by applicant.

Claims 5, 45, 46, 47, 48, 51, 52, 55 and 56 are rejected as unpatentable over Dubbs 1,534,927. A portion of the oil heated in coil B of Dubbs would be converted in the vapor phase as well as in applicant's claimed process since Dubbs discloses a temperature of 850° F. which is within applicant's range of 600-900° F.

231 Claim 8 is rejected as unpatentable over Von Groeling in view of Alexander or Behimer. To substitute the cracking coil of Behimer or Alexander (75 in Fig. 5) for the heater A of Von Groeling and to vaporize the oil therein as taught by these references would not require invention.

Claims 12, 13, 15, 16 and 17 are rejected as unpatentable over Biddison et al in view of Von Groeling. To preheat charge oil and introduce it into cracking zone 8 of Biddison lacks invention. Or, in other words, to place such a chamber as shown at 3 by Biddison in line A^m of Von Groeling would not require invention. In order to read claim 24 on applicant's disclosure, the upper part of cracking chamber 36 is read as the "reflux condenser" of this claim. This reflux condenser is therefore no more than that shown by Von Groeling in the upper part of B.

Claims 16 and 17 are rejected as unpatentable over Dubbs 1,799,413 in view of Hanna. Although carbon and tar pass into tank C of Dubbs, they are separated from the oil therein and do not return to the coils so that Dubbs' procedure is considered the equivalent to applicant's claimed process in this respect. To reflux in contact with fresh oil in Dubbs lacks invention in view of Hanna.

Claims 22 and 33 are rejected as unpatentable over Barbet in view of Dubbs 1,525,281. To crack the oil in 7 of Barbet in a cracking coil and reaction zone such as shown at B and D of Dubbs and to dephlegmate the cracked
232 vapors in countercurrent to charge oil as taught by Dubbs lacks invention since such changes produce only such results as would be expected from the teaching of the references.

Claim 24 is rejected as unpatentable over Dubbs 1,534,927 in view of Jenkins. To decrease the pressure in K^1 with respect to B of Dubbs lacks invention in view of Jenkins.

Claim 49 is rejected as unpatentable over Dubbs 1,534,927 in view of Rosenbaum or Behimer. The steam injected into line L of Dubbs at Y or Y^1 is an inert gas in the same sense as those gases disclosed by applicant. It is thought enbaum would add only such results obviously to be expected from such a change.

Claims 2, 3, 5, 13, 45-48 inclusive, 51, 52, 55 and 56 are rejected as unpatentable over Rosenbaum in view of Behimer. It is thought that some vaporization would take place in coil 27 of Rosenbaum, but even if not to partially vaporize the oil in coil 27 lacks invention in view of Behimer.

Claims 3, 45-48 inclusive, 51, 52, 55 and 56 are rejected as unpatentable over Sherman. Since the vapors from coil 7 entering the space above the crude oil 9 are at a higher temperature than the crude oil, it is thought that they would give up some of their heat to the crude oil. Nevertheless, the expression "cracking chamber to which no extraneous heat is applied" is thought too indefinite
230 to constitute a patentable distinction over
this reference. Moreover, it is thought that the heat supplied to chamber 36 of applicant by the heated products in lines 44 and 48 might be considered "extraneous heat", for this heat comes from outside the chamber. The temperature range of 650-850° F. disclosed by Sherman falls within the range of 600-900° F. disclosed by applicant, and hence if applicant gets vapor phase cracking at this temperature so must Sherman in coil 7.

Claim 4 is rejected as unpatentable over Hanna or Burton et al. The heat supplied to zone 5 of Hanna and zone 10 of Burton et al which effects the cracking in these respective zones comes from the heated materials delivered to these zones.

Claims 4, 8 and 50 are rejected as unpatentable over Dubbs 1,534,927 in view of Von Groeling. To preheat the charge oil in Dubbs lacks invention in view of Von Groeling. Moreover, to heat the oil in A of Von Groeling in a cracking coil as shown at B by Dubbs would not amount to invention. Some of the oil in coil B of Dubbs would vaporize and the vapors be cracked as well as in the process of these claims since Dubbs discloses a temperature of 850° F. which is within the range of 600-900° F. disclosed by applicant.

Claims 5, 45, 46, 47, 48, 51, 52, 55 and 56 are rejected as unpatentable over Dubbs 1,534,927. A portion of the oil heated in coil B of Dubbs would be converted in the vapor phase as well as in applicant's claimed process since Dubbs discloses a temperature of 850° F. which is within applicant's range of 600-900° F.

231 Claim 8 is rejected as unpatentable over Von Groeling in view of Alexander or Behimer. To substitute the cracking coil of Behimer or Alexander (75 in Fig. 5) for the heater A of Von Groeling and to vaporize the oil therein as taught by these references would not require invention.

Claims 12, 13, 15, 16 and 17 are rejected as unpatentable over Biddison et al in view of Von Groeling. To preheat charge oil and introduce it into cracking zone 8 of Biddison lacks invention. Or, in other words, to place such a chamber as shown at 3 by Biddison in line A^m of Von Groeling would not require invention. In order to read claim 24 on applicant's disclosure, the upper part of cracking chamber 36 is read as the "reflux condenser" of this claim. This reflux condenser is therefore no more than that shown by Von Groeling in the upper part of B.

Claims 16 and 17 are rejected as unpatentable over Dubbs 1,799,413 in view of Hanna. Although carbon and tar pass into tank C of Dubbs, they are separated from the oil therein and do not return to the coils so that Dubbs' procedure is considered the equivalent to applicant's claimed process in this respect. To reflux in contact with fresh oil in Dubbs lacks invention in view of Hanna.

Claims 22 and 33 are rejected as unpatentable over Barbet in view of Dubbs 1,525,281. To crack the oil in 7 of Barbet in a cracking coil and reaction zone such as shown at B and D of Dubbs and to dephlegmate the cracked
232 vapors in countercurrent to charge oil as taught by
Dubbs lacks invention since such changes produce only such results as would be expected from the teaching of the references.

Claim 24 is rejected as unpatentable over Dubbs 1,534,927 in view of Jenkins. To decrease the pressure in K^1 with respect to B of Dubbs lacks invention in view of Jenkins.

Claim 49 is rejected as unpatentable over Dubbs 1,534,927 in view of Rosenbaum or Behimer. The steam injected into line L of Dubbs at Y or Y^1 is an inert gas in the same sense as those gases disclosed by applicant. It is thought extremely likely that some cracking would take place in tank K[1], but to maintain this zone at a cracking temperature lacks invention in view of Behimer or Rosenbaum.

For the reasons given above it is respectfully submitted that the final rejection should be sustained.

C. S. DUNCOMBE
Examiner, Div. 31.

278 Endorsed: U. S. Patent Office Board of Appeals
Mar 13 1936 Mailed

Appeal No. 14,817 Paper No. 29
Decision.

Hearing: February 5, 1936 REH

In the United States Patent Office

Before the Board of Appeals

Ex parte Henry L. Doherty

Application for Patent filed January 19, 1929, Serial No. 333,650, a division of application No. 361,030, filed February 24, 1920. Process of Distilling Oils.

Mr. Edmund G. Borden for applicant.

This is an appeal from the action of the primary examiner finally rejecting claims 1-5 inclusive, 8, 12, 13, 15, 16, 17, 22, 24, 33 and 45-56 inclusive.

Claims 1, 12 and 16 will serve as illustrative of the subject matter involved.

1. A continuous process of distilling oil, comprising passing a stream of hydrocarbon oil through a heating zone under a superatmospheric pressure, vaporizing portions of said oil in said zone and heating the resulting vapors, and unvaporized oil of said stream to a high temperature sufficient to crack a substantial portion of the same,

preheating fresh oil and introducing it into an unheated cracking zone in which an enlarged body of liquid oil is retained, introducing said highly heated vapors while at a cracking temperature into direct contact with the body of oil in said cracking zone, whereby the oil of said body is heated to a cracking temperature and portions thereof converted into lower boiling products, subjecting the resulting vapors to reflux condensation and returning portions of the heavier condensate to said heating zone to be further subjected to the cracking conditions maintained therein.

279 12. A process of converting oil, comprising passing oil in a continuous stream through a heating zone to vaporize portions of the oil, heating the vapors and unvaporized oil in said zone to a temperature sufficient to effect cracking thereof, passing the resulting products into an enlarged chamber, maintaining an enlarged body of liquid oil in an unheated cracking zone under cracking conditions of temperature and pressure, preheating fresh charging stock and introducing it into said body, and passing vapor and liquid products from said chamber into said cracking zone in contact with the body of oil therein thereby to maintain the body of liquid oil at a cracking temperature.

16. The process of cracking petroleum oils, which comprises passing oil to be cracked through a heating zone where the oil is heated to a cracking temperature, delivering the heated oil into an unheated vapor separating zone in which an enlarged body of oil is maintained at a cracking temperature and where carbon and tar is separated from oil with which it is mixed, withdrawing the carbon and tar from said zone, passing vapors from said zone in heat exchange with charging oil in a reflux condenser, passing reflux condensate and charging stock from said condenser and clarified tar-and-carbon-free oil from said separating zone into an enlarged chamber, and passing oil from said chamber into said heating zone.

The references relied upon by the examiner are:

Barbet,	836,732,	Nov. 27, 1906,
Sherman,	1,260,584,	Mar. 26, 1918,
Cosden et al,	1,261,215,	Apr. 2, 1918,
Trumble,	1,281,884,	Oct. 15, 1918,

von Groeling,	1,295,088,	Feb. 18, 1919,
Rosenbaum,	1,324,983,	Dec. 16, 1919,
Biddison et al,	1,345,740,	July 6, 1920,
Alexander,	1,407,619,	Feb. 21, 1922,
Hanna,	1,408,698,	Mar. 7, 1922,
Knox,	1,428,641,	Sep. 12, 1922,
Burton et al,	1,448,254,	Mar. 13, 1923,
Setzler,	1,449,452,	Mar. 27, 1923,
Dubbs,	1,525,281,	Feb. 3, 1925,
Dubbs,	1,534,927,	Apr. 21, 1925,
Behimer,	Re. 16,877,	Feb. 14, 1928,
Dubbs,	1,799,413,	Apr. 7, 1931,
Taveau,	1,936,735,	Nov. 28, 1933,
Jenkins	1,440,996,	filed Nov. 4, 1918,

Interference No. 58,781 (consolidated with Interference No. 55,948.) Taveau the winning party in Interference No. 58,781.

The claims on appeal are directed to the treatment of hydrocarbon oil to remove low boiling constituents and to convert the constituents of higher molecular weight 280 into lower forms. This conversion is effected by a cracking process which involves the application of no external heat to the cracking chamber, the necessary heat being supplied by passing a portion of the oil which is to be introduced into such chamber rapidly through a heating coil where it is heated to a cracking temperature. In the heating coil and in the cracking chamber, the oil is maintained under considerable pressure. After passing through the heating coil, the vapors which may be formed therein are allowed to separate from the oil and are introduced into the cracking chamber at a different point from the oil of which they originally formed a part. In the cracking chamber these vapors pass upwardly through bodies of oil which, in the upper portion of the chamber, are of preheated stock, and in the lower part of the chamber such preheated stock mingled with the oil which has passed through the cracking coil and the separating zone without vaporization. The charging stock referred to may include previously untreated oil and, additionally, a carefully regulated condensate supplied from any selected part of the condensing elements 16, 18, 20, 22, 24, 26, 28 and 30.

The upper portion of the cracking chamber is provided with a reflux condenser from which material also passes to the bodies of oil in the various trays which substantially fill the cracking chamber.

Many of the claims before us on appeal involve the question of vapor-phase cracking. Some of these claims have been before us in connection with an interference proceeding in which this application was involved. In that
281 proceeding we held that appellant was not entitled to make claims which definitely involved vapor-phase cracking. These claims are re-presented for a reconsideration of this holding. Other claims, which originally corresponded to the claims considered in the interference, are also before us for consideration of the same question. This second group of claims has been modified to some extent since the termination of the interference proceeding but still involves the vapor-phase limitation.

We have again carefully read the specification of this application without finding therein any clear disclosure that vapor-phase cracking was contemplated or inherently involved in the procedure disclosed. It appears to us that the procedure of the application is directed to the thought of cracking oil at "more desirable lower cracking temperatures". The various statements of the object of the invention, appearing particularly on page 2, lead definitely to this conclusion. For instance, in lines 14-18, appellant says:

"Another feature of the invention contemplates separating vapors from an oil which has been heated to a cracking temperature and passing the vapors and oil through a cracking chamber in countercurrent paths".

The specification then goes on to state that by this expedient the oil in the cracking chamber is uniformly heated and agitated by vapors and gases which may be optionally added. This paragraph concludes with the statement:

"In this way, the more desirable lower cracking temperatures may be maintained for cracking and the oil may be held for any desired period of time under the proper cracking conditions".

282 On page 4, reference is made to the introduction of previously treated oil into the cracking zone and here again it is stated that it "has been heated to the most

advantageous cracking temperature''. Later, on page 5, in referring to the gas and vapors, their path is described with respect to the oil in the cracking chamber and a statement is made that they transfer to the oil "any superheat which they may possess''.

On page 6 of the specification, reference is made to the oil vapors which are formed in the pipe still and the gases flowing in parallel current therewith. In this statement, it is said:

> "They are heated to a cracking temperature and the gas is saturated with vapors which are also heated to a cracking temperature.''

A similar statement appears at the bottom of page 17. It is on these statements that appellant most strongly relies in his contention that vapor-phase cracking is disclosed in the application. It seems to us that the quoted statements do not necessarily involve cracking the materials which are said to be heated to a cracking temperature. Bearing in mind that the object of the invention was to crack in an external unheated still and at the more desirable lower temperatures, it seems to us that appellant merely contemplated using the oil, vapors and gases passed through the pipe still in a rapid manner as carriers for heat for introduction into the cracking zone. In other words, the statement that the vapors and gases are raised to a cracking temperature seems to us to mean that they are given a temperature sufficient to produce liquid-phase cracking in the body of oil to which they carry heat.
283 This appears particularly true in view of the fact that one of the materials described as being raised to cracking temperature may be air, as set forth in the last four lines of the specification.

Claims 50-56, previously passed on by us, involve vapor-phase cracking as do also claims 1, 3, 5, 8, 12, 13 and 16 not previously considered in their present form. It is still our view that these claims are not supported by the application as filed.

Certain of these claims 1, 3, 5, 8, 12, 13 and 16, and claims 2, 4, 45, 47 and 48, as well, have been rejected on the ground of estoppel. Appellant contends that, inasmuch as they are substantially the same as claims presented by motion in the interference proceeding, he is not estopped.

An examination of these claims shows that with respect to the claims presented on motion, they have been broadened somewhat. If they still read on, or are not patentable over, the disclosures of other parties involved in interference, appellant is estopped to contest their patentability to him.

Appellant apparently admits that these claims, except 12 and 13, are readable upon the Taveau disclosure, Taveau having been one of the parties to the interference in question. It seems to us that there is a clear estoppel as to such claims. As above indicated, claims 12 and 13 involve vapor-phase cracking and are unpatentable to appellant for that reason.

Many of the claims above considered have been rejected on additional grounds but it seems to us that the
284 references relied upon are not sufficient to fairly anticipate the claims which definitely involve vapor-phase cracking. The patent to Knox is perhaps the closest reference to this phase of the procedure involved. This patent teaches the cracking of an oil in an externally unheated reaction chamber by introducing to such chamber highly heated gases which preferably consist of natural gas or casing head gas. A vapor line 43 communicates with the gas line where it enters the heating zone, and it is the examiner's view that vapors entering through this line are cracked in vapor phase in the heating zone where the temperature is raised to 1300° F. or thereabouts.

Appellant contends that vapors could not enter this gaseous stream because of the fact that the pressures are equalized. It seems possible that the vapors formed in chambers 19 and 21 might pass through pipe 22 and off through the line 36 as well as through the line 43. In any case, whether or not vapor-phase cracking occurs in the heater 25 depends to a considerable extent on the time consumed in passing through this heating zone. It is conceivable that some vapor-phase cracking might occur at the temperatures employed. Whether the gaseous stream entering reaction chamber 23 contains hydrocarbons cracked in gaseous phase or not, the gases are not introduced into the body of oil, as required by claim 2, which is perhaps the broadest of the claims rejected on this reference.

Many of the references relied on by the examiner do

broadly teach what we construe to be the generic
285 teaching of appellant's application, the utilization
of highly heated oil or the vapors thereof, and in some cases additional gases for the introduction of heat into a body of oil maintained in an externally unheated cracking zone; but the claims on appeal, for the most part, include additional features not shown in any one reference along with the procedure outlined. We are not satisfied that the references are fairly combinable to meet the procedure of the claims now specifically under consideration.

Claims 16 and 17 involve delivering the heated oil from the cracking coil to a separating zone, wherein vapors are allowed to pass off and whence they are introduced into a body of oil in a refluxing condenser. In rejecting these claims, the examiner relies on the patents to Biddison et al and von Groeling, taken together.

The Biddison et al patent shows it old to pass oil from a heating coil to a separating chamber, wherein tar or carbon is separated. From this chamber it passes to another chamber which is described as a storage chamber from which gas and vapor pass to a condenser. As we understand the Biddison et al patent, the chamber 3, wherein tar and carbon are separated, is not utilized also to separate the liquid oil. Apparently, both the oil and the vapors pass from this chamber to the storage tank. No reflux condenser is disclosed in this cycle. Claim 17 includes a second enlarged zone which might be satisfied by the storage chamber 8 of Biddison et al but, as above indicated, Biddison lacks a disclosure of separating gas in chamber 3 and the passing of such vapor to a reflux condensing zone.

The von Groeling patent shows a heating zone
286 and an enlarged cracking zone to which oil and vapors from the heating zone may pass. The charging stock is introduced into this zone, and vapors given off therefrom and from the previously-heated material are dephlegmated in separate zones C and C′. In our opinion, these claims are not fairly anticipated by any obvious combination of the disclosures above discussed.

Claims 22 and 33 stand rejected on the patent to Barbet in view of the patent to Dubbs, 1,525,281. The patent to Barbet shows apparatus for rectifying petroleum which involves passing previously heated oil to a chamber or chambers labeled "black pots". Both vapors and oil are led from this chamber to a rectifying column, whence the vapors pass to a condenser.

The Dubbs patent discloses the passage of oil through a heating coil and the discharge of the same into an enlarged chamber D, wherein conversion takes place. From this tank, vapors may pass to a dephlegmating column. Only oil in vapor form is passed from this reaction chamber to the dephlegmating zone. While both oil and vapor are passed from the chamber 7 of Barbet to a rectifying column, we find no clear suggestion of utilizing the same expedient in a procedure such as is followed by Dubbs.

Claim 24 stands rejected on Dubbs patent 1,534,927, in view of Jenkins. The Dubbs patent referred to teaches the passing of oil from an enlarged body of oil through a heating zone where it is raised to a cracking temperature. The oil thus heated is delivered to chamber K', wherein
287 separation of vapors takes place. While this zone
is not described as a cracking zone, we think it reasonable to assume that cracking will take place therein, as apparently the oil when introduced is at cracking temperature, and the time during which it remains sufficient for some conversion. The same is true of the chamber K^3 into which the oil passes after leaving the chamber K'. Vapor is passed from both these zones to a dephlegmator and the dephlegmate returns to K^3, whence a part may pass with the residual oil to the heating coils. There is no definite disclosure in this patent of maintaining the still (chamber K^3) at a lower pressure than the chamber K' and the heating coil. As the examiner says, however, the use of different pressure is suggested by Jenkins. In our opinion, claim 24 is not patentable over the references relied on.

Claim 49 is rejected on the Dubbs patent just discussed, in view of Rosenbaum or Behimer. Claim 49 involves passing an inert gas in intimate contact with the separated, vaporized oil constituents while maintaining the same at a cracking temperature. The Dubbs patent above discussed teaches the introduction of steam into the charging line. We agree with the examiner that this claim is not patentable over Dubbs, whether or not actual cracking is contemplated in zones K' and K^3, especially in view of the other references referred to, wherein there is a clear teaching of carrying on the cracking reaction in an externally unheated zone.

288 The examiner's action with respect to claims 16, 17, 22 and 33 is reversed. His action with respect to claims 1-5 inclusive, 8, 12, 13, 45-48 inclusive and 50-56 inclusive is affirmed, except on prior art. His action as to claims 24 and 49, which stand rejected on prior art, is affirmed.

EUGENE LANDERS
Examiner-in-Chief

P. P. PIERCE
Examiner-in-Chief

F. EDINBERG
Examiner-in-Chief
Board of Appeals

March 13, 1936

289 Endorsed: Board of Appeals Apr 20 1936 U. S. Patent Office

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In the United States Patent Office

Before the Board of Appeals

Application: Henry L. Doherty
Serial No. 333,650 Filed Jan. 19, 1929
For: Process of Distilling Oils

Request for Reconsideration

The applicant named above hereby respectfully requests that the Honorable Board of Appeals reconsider certain points raised in its decision dated March 13th, 1936. The decision is believed to contain certain holdings comprising new grounds of rejection which materially affect the interpretation of the applicant's disclosure as well as the interpretation of claims previously allowed thereon, particularly in the parent application. Other rights which the applicant considered protected in the prosecution of his application are also affected.

Briefly stated, the holdings contained in the Board's decision and which should receive reconsideration are as follows:

1. There is no cracking of any of the oil passed through the coil heater 54.

2. The claims 1 to 5, 8, 12, 13 and 45 to 48 have been "broadened somewhat" with respect to the claims presented on Motion to Amend in Interference No. 58,781, and appellant apparently "admits" that these claims except 12 and 13 are readable upon Taveau, a party to said Interference.

290 *Cracking In Coil 54*

The applicant and his counsel are very much confused by certain statements contained in the decision of the Board of Appeals relating to the question as to whether or not the Board of Appeals considers that cracking takes place in the coil 54. At page 3, line 6 of the decision it is stated that "the oil passed through the coil is heated to a cracking temperature". At line 17 of this same page the coil 54 is referred to as "the cracking coil". At page 4, first paragraph, the Board of Appeals states that it fails to find any clear disclosure of "vapor-phase cracking", and at page 5 they make the following statement after discussing certain portions of the applicant's specification:

"It seems to us that the quoted statements do not necessarily involve cracking the materials which are said to be heated to a cracking temperature."

This statement appears to clearly imply that in the opinion of the Board of Appeals there is no cracking of any of the materials, including the high boiling liquid oil, passed through the heating coil 54.

The applicant doubts that the Board of Appeals intended to make such a sweeping ruling with respect to what happens in the applicant's heating coil 54, because the Examiner never made any such holding and never made any rejection on the ground that there was no cracking at all in the coil 54. In fact, in rereading the Examiner's statement one gets the distinct impression that the Examiner took cracking in the coil 54 as a matter of fact.

An examination of the claims presented in the parent application clearly shows that the applicant considered 291 the coil 54 as a cracking zone (see original claims 1 and 3). Original claim 9 contains the following statement:

". . . continuously advancing a heavy hydrocarbon oil through a still (pipe still 54), circulating gas in contact and in parallel with said oil (coil 54 is the only part of the apparatus in which the oil and gas pass in parallel), gradually increasing the temperature of said oil and gas to a temperature above 500° F. at which said oil will crack (the oil passed through the coil is the only oil referred to),"

This same claim 9 refers to the pipe still 54 as "said cracking zone". Many of the original claims contain similar statements which leave no doubt as to the intention to crack oil in the coil 54, regardless of the fact that cracking was also to be effected in the chamber 36 by utilizing the heat contained in the vapors, gases and liquid oil transferred from the coil into said chamber.

The prosecution of claims in the parent application may be considered further because of claims suggested by the Examiner for Interference purposes. In the Office Letter of June 23rd, 1932, the Examiner suggested two claims for purposes of Interference and each of these claims contain the phrase "subjecting the oil to heat in a cracking zone". This "cracking zone" is the pipe still heater 54. These claims were placed in Interference with a party Kirschbraun and after revision of the Interference Issue, one of the counts (claim 56 of the parent application) contains the following phrase:

". . . heating the oil in a confined stream of restricted cross section in a cracking zone, passing cracked oil from said zone through successive vapor releasing chambers . . ."

292 The opposing party never objected to this claim on the ground that cracking is not effected in applicant's coil 54 in spite of the fact that numerous other extremely technical grounds were raised. This claim (56) has been passed upon by the Examiner of Interferences and the Board of Appeals, and priority of invention has been awarded to the applicant.

The foregoing discussion clearly shows that in the Examiner's opinion cracking of the oil passed through the pipe still heater 54 is effected. The applicant therefore respectfully requests the Honorable Board of Appeals to reconsider the holding referred to above and withdraw any ruling or implication that the oil passed through the heater 54 is not cracked.

At the bottom of page 5 of the Board of Appeals' decision, the question of the cracking of the vapors and gases or the raising of these vapors and gases to cracking temperature is referred to, and at the top of page 6 it is assumed that they are not heated to a cracking temperature because it would be impossible to crack air which is mentioned in the last few lines of the specification. The Board of Appeals will note however, that the reference to air is for its use "as an agitating and vapor carrying medium". It is obvious that the applicant never intended to crack air because he states at page 22, line 10:

"In the process outlined above, the gas introduced is still-head gas which is hydrocarbon that may enter into and assist in chemical reaction or cracking in the still. For many purposes natural gas is preferred to still-head gas because it contains more of the heavy hydrocarbons that may be useful in the formation of gasoline."

293 The statement about the use of air for "agitating" purposes follows the above quotation.

The fact that applicant suggests the use of air and other inert gases for agitating purposes therefore does not show that the oil passed through the coil 54 is not cracked, or that vapors are not cracked in coil 54.

Counsel for applicant does not have a clear idea of what the Board of Appeals has in mind with respect to the functions which take place in the pipe coil heater 54. (The Examiner has refrained and refused to comment on the matter, so that counsel cannot understand the Board's position taken on some claims which say nothing whatever about "vapor phase" cracking or about anything actually being cracked in the coil 54). It seems obvious from the first Office Action that the Examiner did not consider claims 1 to 4 as being directed to vapor phase cracking because he did not reject them along with claims 5 to 8, 10 and 11 as being unwarranted on the ground that the application does not disclose vapor phase cracking in pipe still 54.

The Board of Appeals apparently agrees to the following points with respect to what takes place in coil 54:

1. Liquid oil to be heated is introduced into coil 54 at its cracking temperature from chamber 36.

2. This liquid oil is raised in temperature in coil 54.
3. This oil is also heated to a cracking temperature in coil 54.
4. Some of this oil is cracked in coil 54.
5. A substantial part of the liquid oil is vaporized in coil 54 (in order to supply vapor at high temperature for heating and cracking the body of oil in chamber 36). 294

The phrases in many of the appealed claims relating to the heating of the oil in coil 54 seem to specify no more than what is stated in the above points. Take for example claims 1 and 50. The phrases in question merely require heating to "a high temperature sufficient to crack". (In other words, to a cracking temperature). These phrases do not necessarily require the cracking of either the vapor or the liquid in the coil 54. Certainly there is no recitation of "vapor phase" cracking in either of these claims.

What, then, in the opinion of the Board of Appeals, is the point or phrase in such claims which makes them require "vapor phase" cracking and for that reason lack support in the applicant's disclosure?

The applicant agrees that some of the appealed claims such as claims 5 and 8 for example, "definitely" involve "vapor phase" cracking, but there must be a dividing line at some point in claims covering such varying scope as the appealed claims, between claims which definitely require "vapor phase" cracking and those which do not.

Claims Broadened or Narrowed

In the second paragraph, pave 6 of the Board of Appeals decision, the following statement is found after a listing of claims 1 to 5, 8, 12, 13, 16 (Did the Board of Appeals mean claim 46?), 45, 47 and 48.

"An examination of these claims shows that with respect to the claims presented on motion (in interference No. 58,781), they have been broadened somewhat."

295 In the next paragraph of this page, the decision contains the following statement:

"Appellant apparently admits that these claims, except 12 and 13, are readable upon the Taveau disclosure, Taveau having been one of the parties to the Interference in question."

The applicant does not admit that all of these claims are readable on Taveau.

Since it seems possible that the Honorable Board of Appeals may not have examined these claims in detail because of its impression that applicant admitted them readable on Taveau, the Board of Appeals is respectfully requested to reconsider the ruling at Page 6 with respect to these claims. The Board of Appeals apparently got this impression from the applicant's statement that he had attempted to maintain his right to the claims involved in Interference No. 58,781.

The applicant freely admits that some of the above listed claims read on the Taveau patent disclosure. For example, claims 5 and 46 are not considered materially different from claims 53 and 54, which are claims 1 and 8 respectively of the Taveau patent. (Claims 5 and 46, original claim 11, were identical to claims 1 and 8 of the Taveau patent, but have been amended in an attempt to avoid the Examiner's unwarranted rejections on prior patents. The Examiner's unequal treatment of such identical claims in this and the Taveau applications was decidedly unfair and entirely misleading to the applicant).

However, of the claims referred to above, it is respectfully submitted that claims which involve the presence of liquid oil through the heating coil, that is, claims which definitely specify "partial" vaporization of the
296 oil in the heating coil, are not readable on the Taveau case in which the oil passed through the cracking coil is all vaporized therein. The fact that such claims do not read on the Taveau disclosure is also apparent from the record of the Taveau patent. Claims 1, 12, 13, 45, 47 and 48 definitely specify the *vaporization of a portion* of the oil of the stream passed through the heating coil, and these claims are not readable on Taveau. (Claims 12 and 13 do not read on Taveau because they specify two chambers). Claims 2 and 3 contain the phrase

"vaporizing *oil of* said stream in said zone,"

which phrase obviously means that only a portion of the oil passed through the coil is vaporized. Claim 4 contains no reference to the presence or absence of vapor in the coil, but merely specifies "condensate" which is a liquid.

The remaining claims numbered 5, 8 and 46 are *not* limited to the presence of liquid in the coil or to the vaporization of a *portion* of the oil in the coil, and therefore read clearly on Taveau.

In considering claims which are definitely limited to the vaporization of a portion of the oil in the coil, attention is particularly directed to the statements contained in the specification of the Taveau patent at page 1, lines 77 to 86, and 106 to 109; page 2, lines 31 to 50; and page 3, lines 9 to 18, and 41 to 51. These portions of the specification clearly show that the distillate oil passed into the coil 45 of the converter 14, is completely vaporized, and that the resulting cracked vapors and gases are used for heating the oil in liquid phase in the still 10. Note the language used in one of the citations from the Taveau patent.

297 "The still (10) is unheated externally and the body of oil contained therein receives its heat *solely* from *the vapors* evolved in the vapor phase cracking converter 14, which vapors are conducted by means of a heat-insulated pipe 34 from the converter and delivered in the lower part of the still 10. . ." (page 1, lines 106 to 112).

In the applicant's operation, both vapor and liquid are delivered through the transfer line 60 from the pipe still 54. The liquid and vapor are separated in the separator 62 and the vapor delivered through lines 64 and 48 into the body of oil in the cracking chamber 36. The separated liquid oil is also delivered into the cracking chamber 36 through lines 66 and 44, and it also imparts heat to the oil in the chamber 36. Taveau on the other hand uses vapor as the sole heating means for heating the body of oil in liquid phase in the still 10, as clearly pointed out in the above quotation.

A review of the file wrapper of the Taveau patent shows that all the process claims presented in his original application was strictly limited to vapor phase in the cracking coil, and there is not a single claim broad enough to suggest or include the presence of liquid with the vapor products discharged from the cracking coil.

During the proceedings in Interference No. 58,781, the applicant, among other claims presented on Motion to

Amend, offered claims 1, 2 and 3 as proposed counts 2, 3 and 4, none of which contain positive recitations of vapor phase cracking. Furthermore, proposed count 2 (claim 50) was definitely limited to the step of "vaporizing portions of said oil in said zone", and proposed counts
298 3 and 4 (claims 51 and 52) contain the phrase "vaporizing *oil of* said stream in said zone" which as stated above, means partial vaporization. The applicant presented by Motion to Amend claims of all possible scope which had any semblance of reading on the Taveau disclosure, in order to avoid any question of estoppel. During the Interference Proceedings, the question of *partial* vaporization of the oil in the coils of the respective parties was not raised or considered, but after the Interference had been dissolved, the party Taveau abandoned any right to proposed counts 2 and 3 (claims 50 and 51), although he did introduce proposed count 4 (claim 52) into his application as a claim numbered 35, in an amendment dated September 29th, 1930. Interferences No. 55948 and No. 58,781 were redeclared between Isom and Taveau on July 22nd, 1931, the latter Interference comprising only claim 35 of Taveau which was the applicant's proposed count 4 or claim 52.

After the Interferences were closed, the Examiner on June 20th, 1932 rejected Taveau's claim 35, which Taveau amended on December 19th, 1932, but cancelled on April 20th, 1933. The reason for the cancellation is not apparent in the record of the Taveau patent, because the Examiner was not allowed to make an Office Action after that of June 20th, 1932, but the party Taveau carried on the prosecution through five or six long amendments by means of interviews with the Examiner.

From the above, it is apparent that Taveau recognized the fact that his disclosure did not support proposed count 2 (claims 1 and 50) which definitely specify the *partial* vaporization of the oil in the coil. Taveau never adopted proposed count 3 (claims 2 and 51) and he abandoned proposed count 4 (claims 3 and 52).

299 The Honorable Board of Appeals in view of the foregoing discussion, is respectfully requested to examine claims 1 to 5, 8, 12, 13 and 45 to 48 on the question of whether or not they have been broadened with respect to claims presented on Motion in Interference No. 58,781.

The applicant has carefully examined these claims since reading the Board of Appeals' decision, and finds that every one of these claims have been limited to a continuous cracking process and that practically all of the claims have been specifically limited to a gasoline-making process. (The proposed counts were not limited to a continuous process or to the manufacture of gasoline by cracking).

Some incidental amendments made to these claims are not in the nature of limitations. For example, a statement that a portion of the oil is converted to gasoline is merely a statement of fact, because no known cracking operation converts the oil *completely* to gasoline.

Claims 1, 2, 3, 12 and 13 never required vapor phase cracking, although they specified the heating of vapors and unvaporized oil to a cracking temperature for use in heating and cracking the enlarged body of oil in the cracking chamber 36.

Some claims (for example claims 5 and 8) still contain the original limitations that definitely required vapor phase cracking. These two claims cannot be said to be broader than proposed counts 5 and 8 but they must be said to be narrower, if the changes to a continuous gasoline-making process have such an effect, or if other minor amendments are considered. In no sense can these claims be said to have been broadened with respect to the proposed counts presented on Motion.

300 Other claims such as claims 45, 47, 48 which cover the same cycle of operations as claims 5, 8 and others, were amended to specify partial vaporization of the oil in the coil. These claims do not read on the Taveau disclosure for the reasons pointed out above, and they do not require vapor phase cracking or the cracking of vapors formed in the heating coil.

The above facts show that the claims referred to by the Honorable Board of Appeals have not been broadened with respect to claims presented on Motion. As a matter of fact the claims have been narrowed. It is obvious that none of this group of claims are broader than the broadest patentable claims presented on Motion to Amend by the applicant

At page 6 of the decision of the Board of Appeals, it is stated that if the above-mentioned claims "still read, or are not patentable over," the other parties to the Interference, appellant is estopped to contest their patentability.

Interference No. 58,781 was merely dissolved with respect to the applicant and no award of priority was made against the applicant so that Taveau is not the winner over the applicant, regardless of the fact that he has been granted a patent. The applicant has preserved substantially the whole group of claims presented on Motion in said Interference, as well as narrower claims directed to substantially the same subject-matter, many of which do not read on Taveau. Estoppel therefore cannot be based on
the fact that some of the claims listed above still
301 read on Taveau, because there is no estoppel with
respect to broader claims 50 to 56 (No award of priority was issued against applicant and the question of estoppel should not be confused with the question of the right to make the claims based on the applicant's disclosure).

The primary excuse for the doctrine of estoppel is to prevent the declaration of another Interference and the subjection of the opposing parties to repeated litigation. In the present instance, there is no apparent possibility of another Interference with the party Taveau because Taveau has his patent and all claims of the patent which would read on applicant's cycle are definitely limited to "vapor phase" cracking. Furthermore Taveau has abandoned the subject-matter of claims 1 to 3 and 50 to 52 which comprised proposed counts 2, 3 and 4 of Interference No. 58,781.

If an Interference ever should be declared between the applicant and the Taveau patent, it would not be because of claims 1 to 5 etc., but because of claims 54, 55 and 56, against which there is no estoppel. There is therefore no reason for applying estoppel against claims 1 to 5, 8, etc.

Even if Taveau had been awarded priority over the applicant on claims 50 to 52, the applicant would be clearly entitled to these claims because of such abandonment, for the same reason that a losing party in an Interference is entitled to a patent on the issue where the winning party abandons the invention of the issue.

The Board of Appeals' attention is respectifully directed to its decisions in the case of Ex parte Johnson, 20 Pat. Q. 284 and Ex parte DesRosiers, 17 Pat. Q. 272. In the latter case, the Interference was dissolved and the
302 junior party was held not estopped as to broader
claims than the issue where the senior party failed to reissue his patent and adopt such claims which were pending in the junior party's application. It is respectfully submitted that the applicant is in a much more favorable position than that of DesRosiers.

In the present instance there is no estoppel against the applicant on the broad claims 50 to 56, and it respectfully submitted that under such conditions, the applicant is in the position of a winning party in an Interference. In other words, there is no laches against the applicant, and where he is not estopped as to broad claims he is certainly not estopped on slightly narrower claims covering somewhat the same invention.

Conclusion

The Honorable Board of Appeals is respectfully requested to reconsider its ruling to the effect that there is no cracking of any of the materials passed through the pipe still 54 including the heavy liquid oil passed through this coil and subjected to cracking conditions. As stated in the foregoing discussion, the applicant cannot understand the Board of Appeals' opinion as to what takes place in the pipe still heater 54. The Board of Appeals' decision should therefore be amplified in this respect.

The foregoing discussion also shows that claims 1 to 5 etc. have not been broadened with respect to claims presented on Motion to Amend by the applicant, but they have been narrowed. The Board of Appeals' decision should therefore be modified accordingly. In view of the
303 fact that these claims have been narrowed, the ques-
tion of estoppel should also be reconsidered and the claims considered separately, because the applicant does not admit that all of these claims or any substantial portion of them read on the Taveau disclosure.

The Examiner's rejection on the ground of estoppel was not made until after the issue of the Taveau patent and it should be apparent from the remarks made above that there is no estoppel as to claims 1 to 5 etc.

Claims containing phraseology of the type of that contained in claim 1, relative to the vaporization of a portion of the oil in the coil 54 and the heating of the vapors and unvaporized oil to a cracking temperature, in the applicant's opinion does not suggest or involve the actual cracking of the vapors in the heating coil. Applicant therefore respectfully requests an explanation of the Board of Appeals' opinion as to such claims. Applicant would also appreciate a recommendation for amendment of such claims, if the Board of Appeals still considers them to definitely require vapor cracking.

Respectfully submitted,

EDMUND G. BORDEN
Attorney for Appellant

New York, N. Y.
April 18, 1936

304 Endorsed: U. S. Patent Office Board of Appeals May 1-1936 Mailed

Appeal No. 14,817 Paper No. 31 REH

In the United States Patent Office

Before the Board of Appeals

Ex parte Henry L. Doherty

Application for Patent filed January 19, 1929, Serial No. 333,650, a division of application No. 361,030, filed February 24, 1920. Process of Distilling Oils.

Mr. Edmund G. Borden for applicant.

Request for Reconsideration

Reconsideration is requested of our decision rendered March 13, 1936.

On page 5 of our decision, we make the statement, after quoting a portion of petitioner's specification:

> "It seems to us that the quoted statements do not necessarily involve cracking the materials which are said to be heated to a cracking temperature."

Petitioner states that this seems to imply that there is no cracking of any of the materials, including the high boiling liquid oil which is passed through the heating coil 54.

Petitioner should note that the quotation from the specification, to which reference is particularly
305 made, contains no reference to oil, the materials to
which we referred were the materials referred to in the quotation and we had no intention of holding that oil might not be raised to a cracking temperature and cracked to some extent in the coil. In fact, as pointed out by petitioner, the specification supports such an operation.

At the end of page 5 of the petition is a list of five points with which it is stated the Board of Appeals apparently agrees. The statement made is in accordance with our understanding and with our intended holding. After making this statement, it is urged that the phrases in many of the appealed claims relating to the heating of oil in coil 54 seem to specify no more than what is stated in the above points and claims 1 and 50 are referred to by way of examples. Petitioner then goes on to quote, from these claims, the requirements as to heating "to a high temperature sufficient to crack". The quoted expression by itself does not necessarily imply vapor-phase cracking but when read in connection with what precedes the same and when completed, we think such an interpretation is required.

Claim 1, for instance, specifies:

> "vaporizing portions of said oil in said zone and heating the resulting vapors, and unvaporized oil of said stream to a high temperature sufficient to crack a substantial portion of *the same*". (Emphasis ours)

While it is possible that "a substantial portion of the same" might refer to the oil portion only, it seems to us
that the claim may be fairly interpreted to mean not
306 only a portion of the oil but a corresponding portion
of the vapors. Similar considerations prompted our holding with respect to other claims not definitely referred to in the petition.

In our decision, page 6, we inadvertently listed claim 16 in two different groups of claims, whereas claim 46 should have been listed. Lines 7 and 11, page 6, should be read *46* instead of "16".

As to the claims which were rejected on the ground of estoppel, because of petitioner's failure to point out wherein they distinguish from Taveau, we took the view that there was an apparent admission that all except claims 12 and 13 did read on the Taveau disclosure. Petitioner now urges that no such admission is made. He does admit, however, that claims 5, 8 and 46 are readable upon Taveau but contends that they are substantially the same as claims presented on motion and that he is therefore not estopped to make them at this time. It is contended that such of these claims as definitely specify "partial" vaporization of the oil in the heating coil are not readable on the Taveau patent because Taveau contemplated a complete vaporization. In as much as it is axiomatic that the whole includes a part, it seems to us that the claims are supported by the Taveau application.

In our decision we held that the claims which read on Taveau other than those presented on motion have been slightly broadened and that petitioner was estopped as to these claims. Petitioner contends that there is no broadening and asks us to reconsider this portion of
307 our holding.

Claim 1 specifies cracking "a substantial part of" the vapors and unvaporized oil of the stream which has been passed through a heating zone. Claim 50, which was presented on motion, specifies heating the vapors and unvaporized oil to a high temperature sufficient to crack the same.

It seems to us that claim 1 has been somewhat broadened with respect to the extent of heating which is to be given to the oil. It may be true that in no case could 100% cracking be expected, but claim 50 as drawn makes no reservations.

Claim 2 specifies heating the oil constituents in the stream which has been passed through the heating zone to a temperature sufficient to crack the same, whereas claim 51, upon which it was apparently based, is specific to the heating of vapors to such a temperature.

While the differences involved in the claims under consideration with respect to the claims upon which they are modeled are not great, we are of the opinion that they are of a character which changes the scope of the claims somewhat in a broadening direction. Petitioner seems to be of the opinion that, inasmuch as some of the claims include additional narrowing limitations, they have not been broadened. We deem it well settled that claims from which limitations have been omitted are broadened, irrespective of the additional limitations which have been made. In this connection, see Fox Typewriter Co. vs. Corona Typewriter Co., 282 Fed. 502.

308 We have carefully reconsidered the matters raised by the petition without concluding that any substantial error was made in our former holding. Except as above indicated, our decision stands as rendered.

The limit of appeal will date from the present decision rather than from the decision originally made.

EUGENE LANDERS
Examiner-in-Chief

P. P PIERCE
Examiner-in-Chief

F. EDINBERG
Examiner-in-Chief

Board of Appeals

May 1, 1936

1.19.29

4/14/37

D. [illegible]

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26. Exam. Stat. SEP 6 1935
27. HEARING FEB 5 1936
28. BRIEF FEB 5 1936
29. DECISION BY BOARD MAR 13 1936 affirmed in part
30. REQUEST FOR RECONSIDERATION April 20/36
31. DECISION BY BOARD MAY 1 1936 Decision remains
32. REQUEST FOR RECONSIDERATION Sept. 15/36
33. DECISION BY BOARD OCT 1 1936 [illegible]
34. Assoc. P. Atty Oct 27/36
35. this date - see paper 33
36. Notice of Suit under Sec 4915 R.S. - Oct. 20 1936
37. Amdt E entd Nov 21/36
38.
39.
40. Not up for action
41. Do not hold abandoned
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43.

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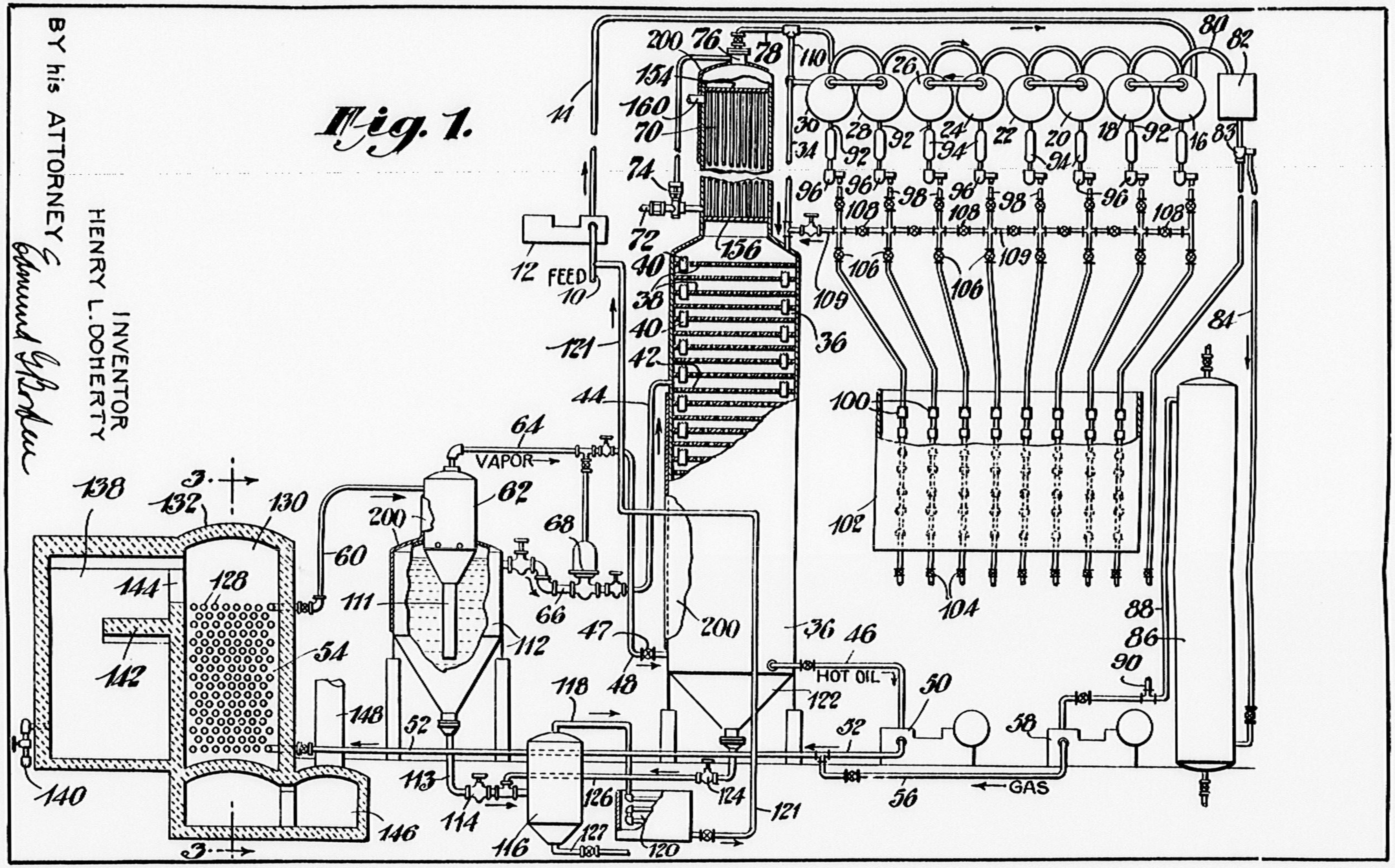
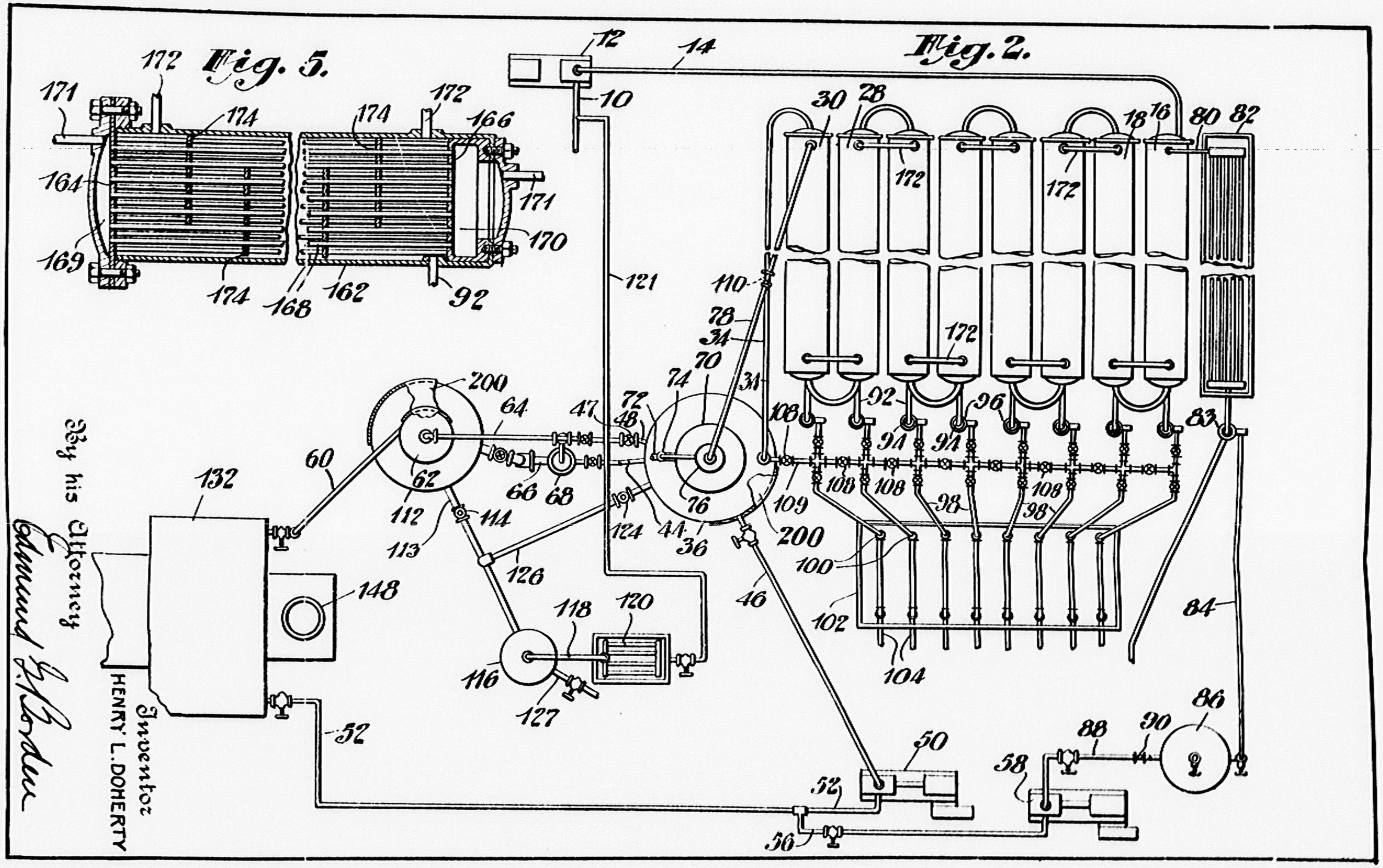
Fig. 1.



INVENTOR
HENRY L. DOHERTY

BY his ATTORNEY



Inventor
HENRY L. DOHERTY

By his Attorney
Edmund G. Borden

Fig. 3.

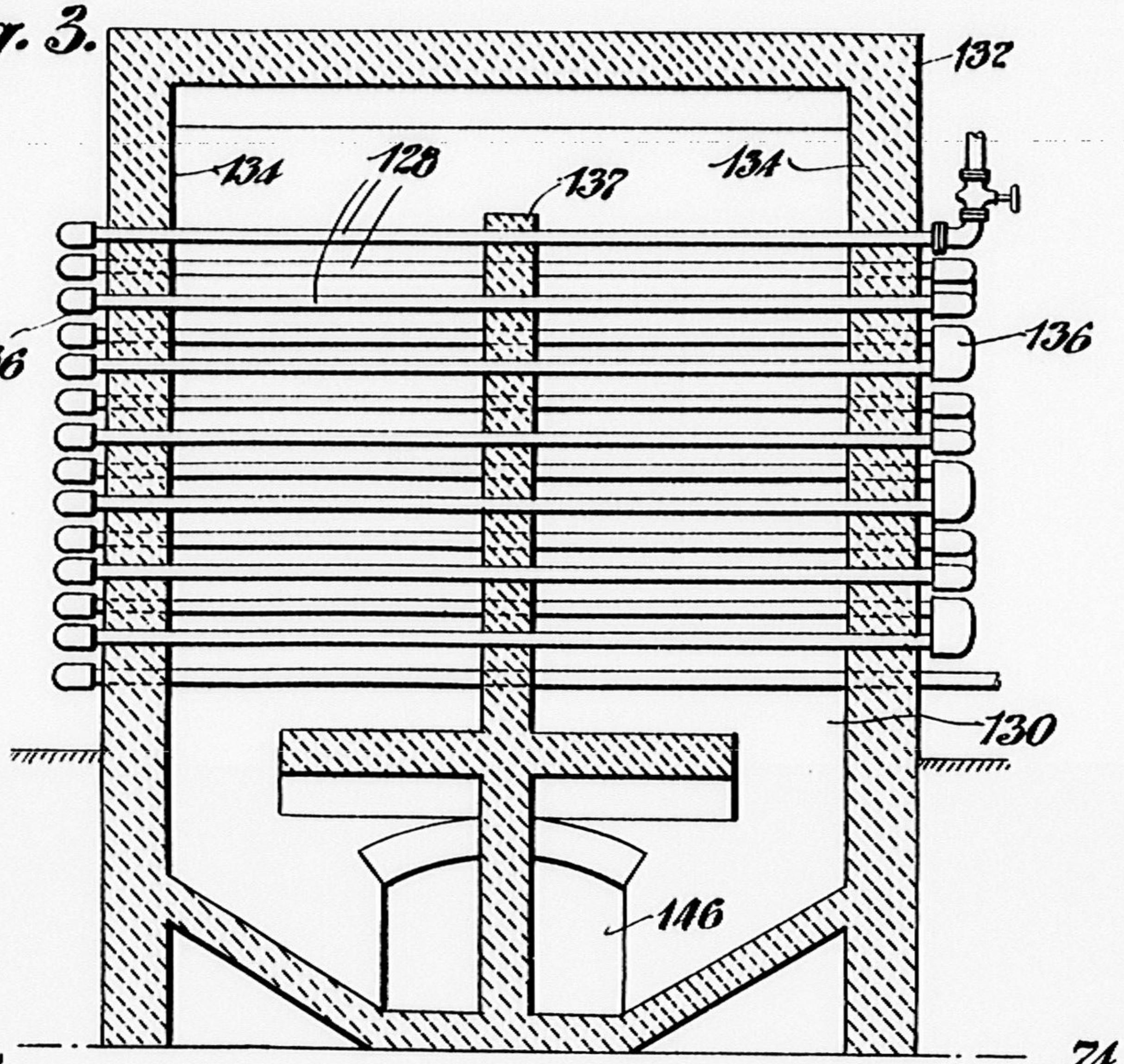
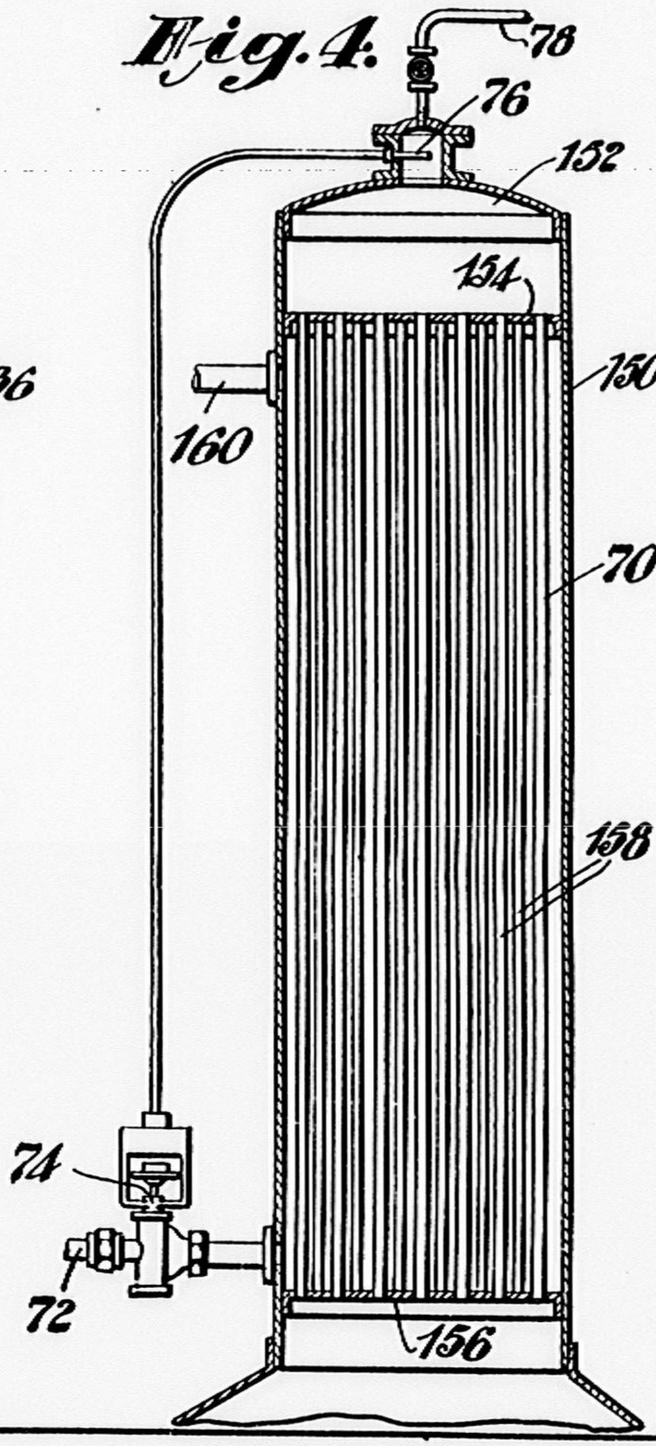


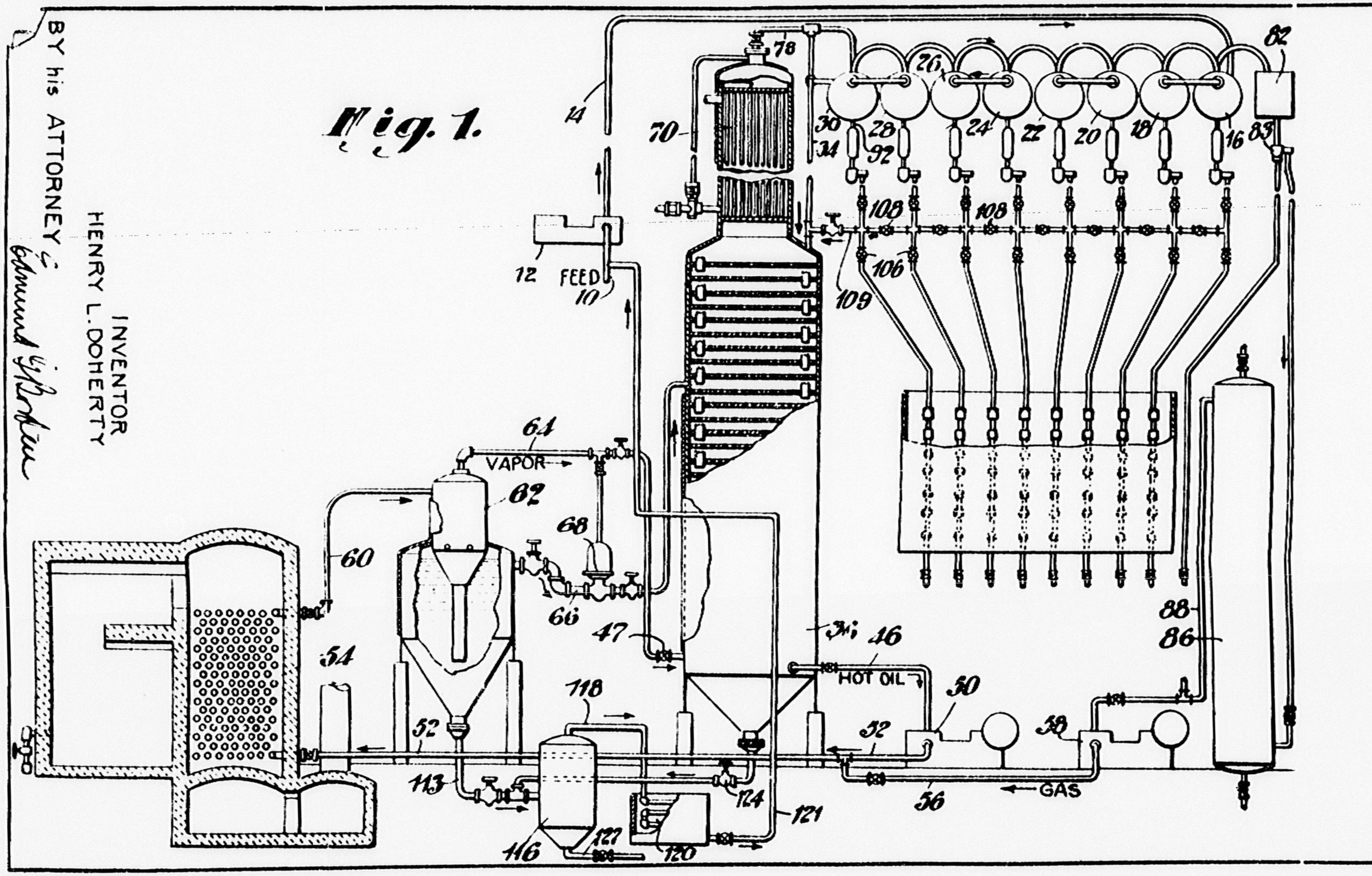
Fig. 4.



Inventor
HENRY L. DOHERTY

By his Attorney

Fig. 1.



Doherty Exhibit #2.

323 *Doherty Exhibit #3*

COMPARISON BETWEEN CLAIM 47 AND CLAIM 50

	Claim 47—Estopped *Not Rejected on Lack of Disclosure*	*Claim 50—Not Estopped* *Rejected on Lack of Disclosure*
Process	“the combined process for cracking oils to produce gasoline”	“process of distilling oil”
Heating Coil	“a heating and cracking zone”	“heating zone”
Material passed thru	“a restricted stream of oil containing reflux condensate derived from the process”	“a stream of hydrocarbon oil” “portions of the heavier condensate”
Vaporization	“vaporized portions thereof”	“vaporizing portions of said oil”
Temperature and Cracking	“heated to a temperature sufficient to vaporize portions thereof and to crack a substantial portion of the oil constituents passing therethrough”	“heating the vapors, and unvaporized oil to a high temperature sufficient to crack the same”
Material Entering Body	“the resulting hot vapor products”	“said highly heated vapors while at a cracking temperature”
Body of Oil	“an enlarged body of oil maintained in a second externally unheated cracking zone”	“a cracking zone where a body of oil is retained”
Contact	“intimately contacting said hot vapor products with the oil of said body”	“introducing said * * * vapors * * * into direct contact with the body of oil”
Cracking	“whereby portions thereof are cracked to lower boiling point gasoline-like products”	“whereby the oil of said body is * * * converted into lower boiling products”
Fractionation	“subjecting the combined vapors produced from the cracking operations to reflux condensation”	“subjecting the resulting vapors to reflux condensation and returning portions of the heavier condensate”
Charge	“introducing charging oil into said second zone”	“preheating fresh oil and introducing it into” * * * the body

324 *Doherty Exhibit #4*

COMPARISON BETWEEN CLAIM 1 AND CLAIM 50

	Claim 1—Estopped	*Claim 50—Not Estopped*
Process	‘‘a continuous process of distilling oil’’	‘‘process of distilling oil’’
Heating Coil	‘‘heating zone’’	‘‘heating zone’’
Material passed thru	‘‘a stream of hydrocarbon oil’’ ‘‘portions of the heavier condensate’’	‘‘a stream of hydrocarbon oil’’ ‘‘portions of the heavier condensate’’
Vaporization	‘‘vaporizing portions of said oil’’	‘‘vaporizing portions of said oil’’
Temperature and Cracking	‘‘heating the resulting vapors and unvaporized oil of said stream to a high temperature sufficient to crack a substantial portion of the same’’	‘‘heating the vapors, and unvaporized oil to a high temperature sufficient to crack the same’’
Material Entering Body	‘‘said highly heated vapors while at a cracking temperature’’	‘‘said highly heated vapors while at a cracking temperature’’
Body of Oil	‘‘an unheated cracking zone in which an enlarged body of liquid oil is retained’’	‘‘a cracking zone where a body of oil is retained’’
Contact	‘‘introducing said * * * vapors * * * into direct contact with the body of oil’’	‘‘introducing said * * * vapors * * * into direct contact with the body of oil’’
Cracking	‘‘whereby the oil of said body is * * * converted into lower boiling products’’	‘‘whereby the oil of said body is * * * converted into lower boiling products’’
Fractionation	‘‘subjecting the resulting vapors to reflux condensation and returning portions of the heavier condensate’’	‘‘subjecting the resulting vapors to reflux condensation and returning portions of the heavier condensate’’
Charge	‘‘preheating fresh oil and introducing it into’’ * * * the body	‘‘preheating fresh oil and introducing it into’’ * * * the body

325

Doherty Exhibit #5

COMPARISON BETWEEN CLAIM 2 AND CLAIM 51

	Claim 2—Estopped Not Rejected on Lack of Disclosure	*Claim 51—Not Estopped Rejected on Lack of Disclosure*
Process	"continuous process of distilling and cracking oil for the production of gasoline"	"a process of distilling oil"
Heating Coil	"a heating zone"	"a heating zone"
Material passed thru	"a mixture of heavy reflux condensate and other oils to be cracked in a stream"	"a mixture of heavy reflux condensate and other oils to be cracked in a stream"
Vaporization	"vaporizing oil of said stream"	"vaporizing oil of said stream"
Material heated	"the oil constituents"	"the resulting vapors"
Temperature and Cracking	"to a temperature sufficient to crack the same" (the oil constituents)	"to a temperature sufficient to crack the same" (the resulting vapors)
Material Entering Body	"the highly heated oil constituents from said zone and * * * the vapors thereof"	"the vapors while hot"
Body of Oil	"an enlarged body of oil in an unheated cracking zone"	"in a cracking zone"
Cracking	"to heat and convert portions thereof into lower boiling products"	"to heat the oil and convert portions thereof into lower boiling products"
Fractionation	"subjecting the vapors produced in both said zones to reflux condensation to separate higher boiling constituents"	"subjecting the vapors produced in both said zones to reflux condensation to separate higher boiling constituents"
Product	"condensing and collecting the desired low boiling products"	"condensing and collecting the desired low boiling products"

Nov. 28, 1933. R. DE TAVEAU **1,936,735**

PROCESS FOR CONVERTING HYDROCARBON OILS

Filed March 30, 1922

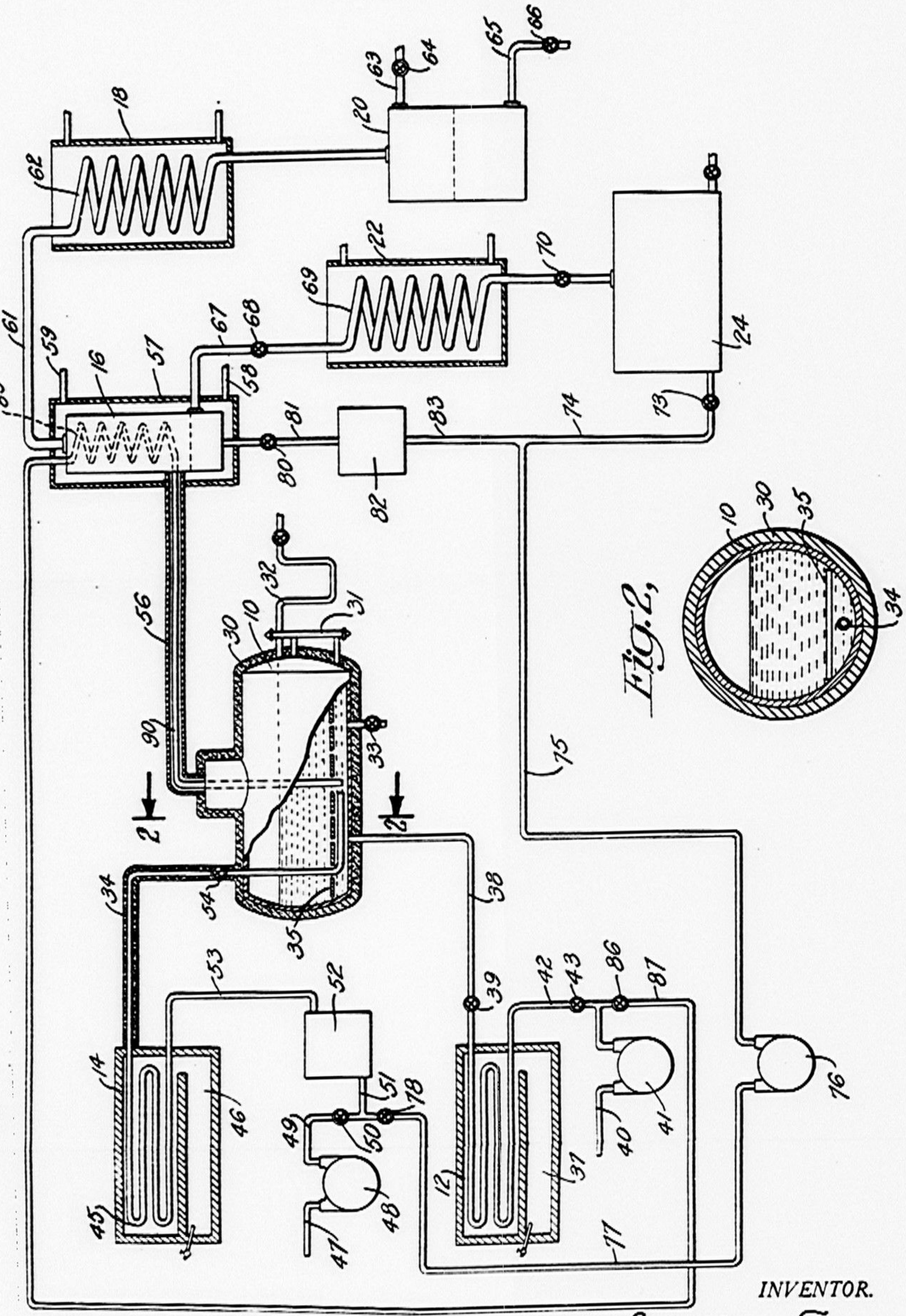


Fig. 1,

Fig. 2,

INVENTOR.

Rene de M. Taveau

BY R.J. Dearborn

ATTORNEY

Patented Nov. 28, 1933 **1,936,735**

UNITED STATES PATENT OFFICE

1,936,735

PROCESS FOR CONVERTING HYDROCARBON OILS

René de M. Taveau, Elizabeth, N. J., assignor, by mesne assignments, to The Texas Company, New York, N. Y., a corporation of Delaware

Application March 30, 1922. Serial No. 547,945

30 Claims. (Cl. 196—66)

This invention relates to the conversion under pressure of high boiling hydrocarbon oil into lower boiling products, and it has special reference to a process and apparatus for effecting the conversion in a combined vapor-liquid phase.

One of the objects of the present invention is to provide a process and apparatus of the character above indicated, which shall combine the respective advantages of vapor phase and liquid phase cracking operations, which shall be simple, efficient and reliable in operation, shall be particularly economical in heat consumption, and which shall avoid the dangers and disadvantages of the heavy deposition of carbon incident to the usual cracking operations.

In vapor phase cracking processes, such as typified, for example, by the Hall process, it is desirable in order to avoid excessive deposition of carbon to supply a relatively clean distillate to the vapor phase converter and to this end it is good practice to subject the oil to be treated to a preliminary distillation process to remove impurities. Moreover, the conduct of a vapor phase cracking process along the lines of the Hall process is accompanied by excessive heat losses, resulting from the waste heat of the high temperature cracked and uncracked vapors evolved in and emerging from the converter.

It is another object of the present invention, therefore, to provide a combined vapor-liquid phase cracking process and apparatus in which the heat of the vapors evolved in the vapor phase cracking operation is conserved and subsequently utilized to raise and maintain a body of oil in an unheated heat-insulated still at a cracking temperature, whereby the oil contained therein is converted in the liquid phase.

Another object of the invention is to separate out from the evolved vapors resulting from the combined vapor phase and liquid phase cracking operations the lighter constituents and to return to the vapor phase converter the heavier constituents which by reason of the treatment which they have undergone in the converter and the still possess suitable characteristics to enable them to be used as the supply of oil for the vapor phase cracking operation, thereby avoiding the necessity of the usual preliminary distillation. The process, therefore, operates to supply oil of the requisite character for its own operation in the vapor phase stage.

A further object of the invention is to provide a process which upon attaining its normal running condition, the heavier constituents of the evolved vapors are utilized to replace, in part or in whole, the supply of distilled oil necessary for the operation of the vapor phase cracking while the operation as a whole is being initiated.

A still further object of my invention is to improve the quality of the final product, which, according to my present belief, is attained by causing the cracked products of the vapor phase operation to mingle and chemically react with the cracked products of the liquid phase operation.

These and other objects of the invention and features by means of which they are attained will be more fully understood from the following description of the process in connection with the preferred embodiment of the apparatus illustrated in the accompanying drawing, in which

Fig. 1 is a diagrammatic view of an apparatus or system constructed in accordance with the present invention and adapted for practicing my improved cracking process, and

Fig. 2 is a sectional view on the section line 2—2 of Fig. 1.

Referring to the drawing, the system shown comprises, in general, a still 10 adapted to receive a body of heavy oil; a heater 12 for preheating the initial body of oil before it is introduced into the still 10; a converter 14, preferably comprising an elongated cracking coil or a tube of restricted cross section, and adapted to crack the oil supplied thereto in the vapor phase and to deliver the highly heated evolved vapors into the body of oil in the still 10, whereby said oil is maintained at a sufficient cracking temperature to effect the conversion of the oil in the liquid phase; a separator or fractionating device 16 for receiving the evolved vapors from the combined vapor phase and liquid phase cracking operations and selectively condensing out the heavier constituents thereof and allowing the lighter constituents of desired volatility to pass on; a condenser 18 for condensing the lighter constituents of the vapors; a collecting tank 20 for receiving the ultimate light distillate; a cooling apparatus 22 for cooling the heavier condensate withdrawn from the separator 16, and a collecting tank 24 for receiving the condensate so cooled.

The still 10 is made of any suitable construction and is heat-insulated by means of a lagging 30. The still is provided with a liquid level gage 31, an overflow pipe 32 and a residue draw-off 33. The still is unheated externally and the body of oil contained therein receives its heat solely from the vapors evolved in the vapor phase cracking converter 14, which vapors are conducted by means of a heat-insulated pipe 34 from said converter and delivered in the lower part of the still 10 beneath a false bottom 35, conveniently comprising a plurality of sheet iron plates or the like. These plates, which rest at their opposite edges upon the walls of the still and are slightly spaced apart, serve the purpose of distributing the hot vapors delivered through the vapor line 34 so as to bring them into intimate contact with the oil in the still.

The preheater 12 may be of any desired construction and, as shown, comprises an elongated coil of restricted cross section that is heated by the products of combustion from a suitable furnace 37 disposed below it. This preheater is connected by means of a pipe 38 having a valve 39 with the bottom of the still 10 and is supplied with a heavy oil, such for instance as crude paraffine gas oil from a suitable source through pipe 40 by means of a pump 41 that is connected to the preheater by a pipe 42 provided with a valve 43. The preheater 12 is utilized only to supply the initial body of preheated oil to the still.

The vapor phase converter 14 may be of any type suitable for vapor phase conversion and is preferably similar in construction to that of the preheater 12 and comprises an elongated coil 45 of restricted cross section that is highly heated by means of a furnace 46 disposed below it. This converter 14 is supplied under pressure with oil of a suitable character from a convenient source through pipe 47, pump 48, pipe 49 provided with a valve 50, a pipe 51, preheater 52 and pipe 53. For vapor phase conversion, the oil must be relatively clean and, therefore, a preliminary distillation of a suitable oil, as for instance—a paraffin gas oil, is resorted to, in order to produce an oil of desirable characteristics for this purpose. The preheater 52 may be heated directly or indirectly, in any manner known to the art. As the oil is forced under pressure through the cracking coil 45 at a rapid rate it is subjected to high cracking temperatures in the neighborhood of from 500–600° C. and is cracked in the vapor phase.

The conversion operation is not restricted to these temperatures and may vary therefrom to a considerable extent, depending upon the character of the oil being treated and other operating conditions. The vapors and gas in the cracking coil 45, including the converted and unconverted vapors, emerge therefrom at high temperatures and are conducted through the heat-insulated pipe 34 and valve 54 and delivered directly into the body of the oil in the still 10. The heat of the vapors and gas, thus introduced into the still, are utilized to raise and maintain the body of heavy oil therein at a sufficient cracking temperature to effect the conversion of the oil in the liquid phase, without the necessity of supplying external heat to the still. The temperature of the still, after the operation of the system has been initiated, is maintained at from 700–800° F., although it may vary therefrom.

The vapors evolved from the liquid phase cracking operation in the still, together with those of the vapor phase cracking operation in the converter 14, are withdrawn from the still through a vapor line 56 and are conducted to the separator or fractionator 16. This separator or fractionator 16 is enveloped by heat-insulated casing or jacket 57 through which either a cooling or a heating medium is circulated by means of the pipes 58 and 59 for the purpose of maintaining the desired temperature to effect whatever selective condensation and consequent separation of the constituents of the evolved vapors as may be determined upon. The lighter uncondensed vaporous constituents of desired volatility emerge from the upper end of the separator 16 and pass through a pipe 61 into a coil 62 comprising a part of the water cooled condenser 18, in which the vapors are condensed. The condensed light distillate is then discharged and collected in the receiving tank 20, having a gas outlet 63 controlled by valve 64 and a distillate discharge outlet 65 regulated by a valve 66.

The heavier constituents of the vapors evolved from the combined vapor-liquid phase cracking operations are condensed in the separator 16 and may be conducted through pipe 67 having a valve 68 and thence through a coil 69 of the water cooled cooler 22, after which it passes through the valve 70 and is collected in the receiving tank 24. The character of the condensate or light residue collected in the tank 24 is such that it may be utilized as the oil supply for the converter 14 for the vapor phase conversion. Therefore, means is provided for returning this condensate and delivering it to the converter 14 for retreatment. This means includes the valve 73, pipe 74, pipe 75, pump 76, pipe 77, and valve 78, whereby the condensate is returned to the converter through the preheater 52. After the process has been initiated and this condensate is produced and collected in sufficient quantities, it may be utilized to entirely replace the distillate originally supplied to the converter 14 through the pipe 47 and pump 48. In this way, the process, after being brought up to normal operating conditions, produces its own supply of oil of a character suitable for the vapor phase cracking operation so that the auxiliary supply of clean distillate may be required only for starting the operation and may thereafter be discontinued. Provided the quantities of clean light residue or condensate are insufficient to supply the requisite amount of oil for the vapor phase cracking operation, it may still be necessary to deliver a restricted quantity of preliminarily cleaned distillate to the converter 14.

In place of abstracting the heat of the heavy condensate by means of the cooler 22, the valves 68 and 73 may be closed, and the valve 80 opened, to permit the condensate, in heated condition, to pass through the pipe 81 and into a collecting tank 82 from whence it is withdrawn through pipe 83 and thence through pipe 75 by means of pump 76 which delivers it through the preheater 52 to the converter 14. In this way the heat of the condensate is largely retained and conserved, thereby creating a heat cycle and contributing to the heat-efficiency of the system as a whole.

The separator or fractionator 16 includes a preheating or heat-exchanger coil 85, through which heavy oil from pipe 40 and pump 41 is delivered to the still 10 after the system is brought up to normal operating conditions. This is effected by closing the valve 43 and opening valve 86 in pipe 87 whereby the pump 41 supplies the heavy oil to be operated upon through the pipe 87 and thence through the preheating or heat-exchanger coil 85 from which the oil is conducted to the still through a pipe 90 disposed within the vapor line 56. The supply of oil is thus subjected to the heat of the escaping vapors evolved from the combined vapor-liquid phase conversion operations and is thus preheated before being delivered into the still near the bottom thereof.

By suitably controlling the pressure valve 64, the entire system may be operated under any desired super-atmospheric pressure which is preferably in the neighborhood of from 75 to 100 lbs., although it may vary below or above this range, if desirable or necessary.

The operation of the system is briefly as follows:

The still 10 is first filled with a heavy oil such as crude paraffin gas oil, to the desired level by means of the pump 41 which forces the oil through the preheater 12 in which the oil is raised to a temperature of from 400–500° F. or thereabouts. Having supplied the necessary volume of oil to the still 10, the operation of the pump 41 and preheater 12 is discontinued and the valves 39 and 43 closed.

Thereafter the vapor phase converter 14 is put into operation and the pump 48 is utilized to deliver a suitable clean distillate, such for example as redistilled paraffin gas oil, from a suitable source through the preheater 52 to the converter 14, in which the oil is cracked under pressure at high temperatures in the vapor phase and the evolved vapors and gas delivered in highly heated condition into the body of oil in the still 10. I have found that distillate may be satisfactorily supplied to a converter composed of 1'' pipe at a rate of from 2 or 3 gallons per minute. The system is operated in this manner for a period sufficiently long to enable the temperature of the body of oil in the heat-insulated still 10 to be gradually raised to the desired liquid phase cracking temperature, after which liquid phase conversion of the heavy oil in the still 10 takes place. Under those conditions, additional heavy oil may be supplied to the still by means of the pump 41 through the pipe 87 and preheater or heat exchanger coil 85, through the agency of which the charging oil is preliminarily heated by the escaping vapors.

After the system has been brought up to normal operating conditions, I have found that good results are secured by supplying heavy oil to the still 10 in the neighborhood of from 2 to 3 gallons per minute. Ordinarily this supply may be continuous, although operating conditions may be such as to make it desirable to introduce the preheated heavy oil intermittently.

The preferred mode of operation of this system is to effect a predominating amount of liquid phase conversion in the still 10, which, by reason of the fact that the still is unheated, depends upon the amount of heat supplied thereto from the vapors evolved in the vapor phase cracking converter 14. It is, however, desirable to operate the vapor phase converter 14 at a relatively low cracking temperature, while still having it supply sufficient heat to the still to maintain the desired degree of liquid phase conversion.

Moreover, it is my present belief that the characteristics of the ultimate distillate are considerably improved by reason of the intermingling of the vapors of the vapor phase and liquid phase cracking operations which are believed to react chemically the one with the other to this end.

The selective separation or fractionation of the lighter and heavier constituents of the combined vapors is regulated by suitably controlling the temperature of the separator 16 so as to allow only those light vapors of desired volatility to pass over into the condenser 18 and distillate collecting tank 20. As already explained, the light residue or condensate withdrawn from the separator or fractionator 16 is, by reason of its previous treatment either in the vapor phase converter 14 or liquid phase still 10, of a character suitable to be returned and to constitute either, in whole or in part, the supply of oil for the vapor phase cracking operation. This is a feature of importance inasmuch as it obviates the necessity of an extended preliminary distillation heretofore required in producing a clean oil for the vapor phase converting operation.

Another feature of importance resides in the fact that the conversion in the liquid phase is conducted in a still which is not subjected to external heat but which is heated internally solely by the heat derived from the vapors of the vapor phase cracking operation. This results in obviating, to a large extent, the dangers of a heavy incrustation or deposition of carbon on the still bottom, inasmuch as the deposition of carbon is greatly reduced, and, moreover, the character of whatever carbon is deposited is such that it may usually be withdrawn through the residue draw-off 33 with facility. This removal of carbon and other heavy residuums from the still may be continuous or intermittent as found necessary or desirable.

In a modified aspect of the invention I contemplate the utilization of the still 10 merely as a vaporizing chamber in which the pressure may be considerably reduced from that of the vapor phase cracking converter 14 or may, in certain instances, be maintained at atmospheric pressure. In accordance with this modified mode of operation, no material amount of liquid phase conversion will take place but the still 10 will function mainly as a vaporizer, from which the vapors are removed to the separator 16 where the desired selective separation is effected. The heavier constituents of the vapors are drawn off and, being of suitable character, are returned to the converter 14 to supply the requisite oil for the vapor phase cracking operation. The system is thus operated in such manner as to provide its own supply of oil for the vapor phase conversion, thereby eliminating the usual preliminary step of redistillation, commonly employed for the purpose of producing a clean quality of oil to be cracked in the vapor phase.

Having thus described, in more or less detail, the nature and character of the present invention as exemplified in the illustrated embodiment thereof, it should be understood that various modifications in the apparatus and the mode of operation may be effected without departing from the spirit and scope of the invention defined in the appended claims.

I claim:

1. The process of converting high boiling hydrocarbon oils into lower boiling products which comprises passing the oil through a converter maintained at a sufficient cracking pressure and temperature to convert the oil in the vapor phase, maintaining a body of oil under pressure in an unheated still, delivering the products from the converter into the body of oil in the still whereby said oil is maintained at a cracking temperature and the oil converted in the liquid phase, separating out the lighter constituents of the evolved vapors and returning the heavier constituents thereof to the converter for retreatment.

2. The process of converting high boiling hydrocarbon oils into lower boiling products which comprises cracking a body of oil in the vapor phase, maintaining a body of oil in an unheated still, delivering the products of the vapor phase cracking operation into the body of oil in the still to maintain said oil at a cracking temperature and to effect the cracking of the oil in the liquid phase, delivering the evolved vapors from both the vapor phase and the liquid phase operations to a separator, separating out the lighter constituents thereof and back-trapping the heavier constit-

uents to supply oil for the vapor phase cracking operation.

3. The process of converting high boiling hydrocarbon oils into lower boiling products which comprises continuously delivering a suitable distillate to a vapor phase converter, continuously delivering a heavy oil to an unheated still, delivering the evolved vapors of the converter into the body of oil in the still whereby said oil is maintained at a cracking temperature sufficient for liquid phase cracking, removing from the still the evolved vapors of both the liquid phase and vapor phase operations, separating out the lighter constituents thereof and continuously returning the heavier constituents to the converter to supply oil to be cracked therein.

4. The process of converting high boiling hydrocarbon oils into lower boiling products which comprises preheating a heavy oil and delivering it to an unheated still to maintain a body of oil therein, subsequently cracking a clean distillate in the vapor phase, delivering the products of the cracking operation into the body of oil in said still to maintain a sufficient cracking temperature therein to effect a liquid phase cracking thereof, taking off the evolved vapors from the still, separating out the lighter constituents thereof, discontinuing the supply of distillate for the vapor phase cracking operation and returning the heavier constituents of the evolved vapors for the vapor phase operation and subsequently supplying a heavy oil to the still and preheating it by the evolved vapors taken therefrom.

5. The process of converting high boiling hydrocarbon oils into lower boiling products which comprises delivering a heavy oil to a still to supply an initial body of oil thereto, delivering a suitable distillate to a cracking coil where it is cracked in the vapor phase at high cracking temperatures and pressures, discharging the evolved vapors into the body of oil in the still to maintain said body at a sufficient cracking temperature and pressure to effect the cracking of the oil in the liquid phase, taking off the evolved vapors, supplying a heavy oil to the still, preheating it by the evolved vapors taken therefrom, separating out the lighter constituents of the evolved vapors and returning the heavier constituents to the vapor phase cracking coil to replace, in whole or in part, the distillate initially supplied thereto.

6. The process of converting high boiling hydrocarbon oils into lower boiling products which comprises supplying to a converter a suitable distillate to be cracked therein in the vapor phase, supplying a heavy oil to an unheated heat-insulated still, discharging the evolved vapors from the vapor phase cracking operation into the body of oil in the still to maintain a sufficient temperature therein for liquid phase cracking, separating out the lighter constituents of the vapors evolved in the vapor phase and liquid phase cracking operations and returning the heavier constituents directly and while still in heated condition to the converter to serve as a suitable distillate for the vapor phase cracking operation.

7. A process of cracking heavier hydrocarbons to produce lighter hydrocarbons which consists in internally heating an externally unheated body thereof in liquid-phase to a cracking temperature under pressure, driving off the cracked hydrocarbons therefrom, condensing the heavier vapors from said cracked hydrocarbons, separately condensing the lighter vapors, separately heating the condensate from the heavier vapors to vaporize and crack the same and injecting them into said body of hydrocarbons.

8. A process of cracking heavier hydrocarbons to produce lighter hydrocarbons which consists in internally heating an externally unheated body of heavy hydrocarbons in liquid-phase to a cracking temperature under pressure and distilling the cracked hydrocarbons therefrom, condensing the heavier vapors of the hydrocarbons and heating the condensate from the heavier vapors to a cracking temperature to vaporize and crack the same, injecting the cracked vapors into said body of hydrocarbons and separately condensing the lighter vapors from said body.

9. The process of converting high boiling hydrocarbon oils into lower boiling gasoline-like products which comprises cracking a charging stock consisting substantially entirely of a normally liquid distillate oil heavier than the desired gasoline-like products in the vapor phase under suitable temperature and pressure conditions for the production of gasoline-like products, utilizing the heat of the evolved vapors of the vapor phase cracking operation to supply heat to a body of oil under pressure in a still to maintain the necessary cracking temperature to effect its conversion in the liquid phase, taking off from the still the evolved vapors of the combined vapor phase and liquid phase cracking operation, fractionally condensing the vapors to separate out heavier constituents thereof and returning at least a portion of the heavier constituents directly to the vapor phase cracking operation.

10. The combined process of cracking high boiling point oils in liquid and vapor phases, which comprises maintaining a relatively large body of oil in a liquid phase cracking zone under cracking conditions of temperature and pressure, conducting an oil distillate in a confined stream through a heating zone in which it is heated and cracked in vapor phase, passing the resulting cracked vapor products while at a high temperature into said body of oil to heat and crack the same, separating the higher from the lower boiling constituents of the vapors evolved in the cracking operations by fractional condensation, and passing the condensed higher boiling point constituents directly into said heating zone.

11. The process of cracking high boiling point hydrocarbon oils into lower boiling point products, which comprises introducing a high boiling point oil into an enlarged cracking zone in which a body of oil is maintained under cracking conditions of temperature and pressure, cracking an oil distillate in vapor phase at a high temperature, conducting the resulting vapor products while hot into said body to crack the oil therein in liquid phase, passing the vapors evolved in the cracking operations from said zone into a vapor fractionating zone in which the higher boiling point constituents are condensed, conducting the resulting condensate directly and while hot to supply at least in part the oil distillate for said vapor phase cracking, and preheating the high boiling point oil introduced into said cracking zone by passing it in heat exchange with hot vapors evolved in the cracking operations.

12. The combined process of cracking high boiling point oils in liquid and vapor phase, which comprises maintaining a relatively large body of oil in a liquid phase cracking zone under cracking conditions of temperature and pressure, conducting an oil distillate through a heating zone in which it is heated and cracked in vapor phase,

passing the resulting cracked vapor products while at a high temperature into said body of oil to heat and crack the same, separating the higher from the lower boiling constituents of the vapors evolved in the cracking operations by fractional condensation; passing the condensed higher boiling point constituents while hot directly into said heating zone, preheating a high boiling point oil by passing it in heat exchange with vapors evolved in the cracking operations and passing it into said body of oil.

13. The process of converting high boiling point hydrocarbon oils into relatively lower boiling point oils, which comprises supplying a distillate oil only to a vapor phase cracking zone maintained under suitable conditions of temperature and pressure to effect cracking of the distillate oil in vapor phase, maintaining a body of high boiling point oil under cracking conditions of temperature and pressure in a separate cracking zone, passing the hot cracked vapors from said vapor phase cracking zone into the body of oil in said separate cracking zone, removing the combined evolved vapors from the last mentioned cracking zone, separating the higher boiling point constituents of the vapors from the lower boiling point products, and passing the higher boiling point constituents directly into the vapor phase cracking zone.

14. The process of converting hydrocarbon oils of high boiling point into lower boiling point gasoline-like products, which comprises cracking a body of high boiling point oil in liquid phase, cracking a stock consisting substantially entirely of a normally liquid distillate oil heavier than the desired gasoline-like products in vapor phase in a vapor phase cracking zone for the production of gasoline-like products, conducting the vapors evolved in the latter cracking operation in heat exchange with said high boiling oil to maintain it at cracking temperature, subjecting vaporous products from said cracking operations to partial condensation to separate as condensate the higher boiling point constituents from the lower boiling point constituents, passing the separated higher boiling point constituents directly to the vapor phase cracking zone, preheating a high boiling point oil by passing it in heat exchange with hot vapors from said cracking operations and conducting it to supply oil for said liquid phase cracking operation.

15. A process of cracking heavier hydrocarbons to produce lighter hydrocarbons which comprises internally heating a body of liquid oil to a cracking temperature, withdrawing converted vaporous products from said oil body, condensing the heavier vapors from said vaporous products, separately heating condensate of said heavier vapors to vaporize and crack the same in the vapor phase, injecting the highly heated cracked products into the said body of oil to effect said internal heating and to maintain said oil body at said cracking temperature, continuously passing fresh oil in indirect heat exchange with products of the operation and adding the preheated fresh oil to said oil body, and substantially continuously withdrawing portions of said oil body.

16. The process of converting hydrocarbon oil which comprises subjecting relatively light hydrocarbon oil to cracking conditions of temperature to effect cracking thereof in the vapor phase, discharging resulting highly heated vaporous products into a body of relatively heavy liquid oil in a separate zone to maintain said oil body at cracking temperature and effect conversion thereof, withdrawing from said body converted vaporous products, subjecting said vapors to fractional condensation, passing resulting condensate to said vapor phase conversion operation as all or part of the charging stock therefor, and substantially continuously supplying additional to said oil body in said separate zone.

17. The process of converting hydrocarbon oil which comprises subjecting relatively light hydrocarbon oil to cracking in the vapor phase under conditions of temperature upwards of 500° C., discharging resulting highly heated vaporous products into a body of relatively heavy liquid oil in a separate zone to maintain said oil body at cracking temperature and effect conversion thereof, separately withdrawing from said body converted vaporous products, and subjecting them to fractional condensation, passing resulting condensate to said vapor phase conversion operation as all or part of the charging stock therefor, and substantially continuously supplying additional heavy liquid oil to said body.

18. The process of converting relatively high-boiling hydrocarbon oil into gasoline-like products which comprises subjecting charging stock consisting substantially entirely of a relatively light normally liquid hydrocarbon oil heavier than the desired gasoline-like products to cracking conditions of temperature in the vapor phase for the production of gasoline-like products, passing resulting highly heated vaporous products in heat exchange relation with a body of relatively heavy liquid oil in a separate conversion zone to maintain said oil body at cracking temperature and effect conversion thereof, passing vaporous products from the said oil body to a fractional condensing operation, passing resulting condensate directly to said vapor phase cracking operation, and substantially continuously supplying additional liquid oil to said body.

19. The process of converting relatively high-boiling hydrocarbon oil into gasoline-like products which comprises subjecting charging stock consisting substantially entirely of a relatively light normally liquid hydrocarbon oil heavier than the desired gasoline-like products to cracking conditions of temperature in the vapor phase for the production of gasoline-like products, passing resulting highly heated vaporous products in heat exchange relation with a body of relatively heavy liquid oil in a separate conversion zone to maintain said oil body at cracking temperature and effect conversion thereof, passing vaporous products from the said oil body together with vaporous products of said vapor phase cracking operation to a fractional condensing operation, passing resulting condensate in liquid form to said vapor phase cracking operation, substantially continuously supplying additional liquid oil to said body and withdrawing oil of said body and avoiding its passage to said vapor phase cracking operation.

20. The method of converting hydrocarbon oils which comprises preheating a substantially continuously flowing stream of a relatively heavy liquid oil and discharging the preheated stream into an enlarged zone wherein said preheated liquid oil is maintained in a body at cracking temperature, withdrawing cracked vaporous products from said liquid oil body and frictionally condensing them, passing resulting condensate in a flowing stream through a heated zone wherein it is subjected to cracking in the vapor phase, and discharging the stream of heated products from said vapor phase cracking zone into the

said body of liquid oil in said enlarged zone to maintain said liquid oil at cracking temperature.

21. The method of converging hydrocarbon oils which comprises preheating a substantially continuously flowing stream of a relatively heavy liquid oil and discharging the preheated stream into an enlarged zone wherein said preheated liquid oil is maintained in a body at cracking temperature, withdrawing cracked vaporous products from said liquid oil body and fractionally condensing them, passing resulting condensate in a flowing stream through a heated zone wherein it is subjected to cracking in the vapor phase, discharging the stream of heated products from said vapor phase cracking zone into the said body of liquid oil in said enlarged zone to maintain said liquid oil at cracking temperature, and withdrawing liquid residual products from said enlarged zone.

22. The process of converting hydrocarbon oil into lower boiling gasoline-like products which comprises passing a stream of charging stock consisting substantially entirely of a normally liquid distillate oil heavier than the desired gasoline-like products through a heated zone wherein it is subjected to cracking in the vapor phase for the production of gasoline-like products, maintaining in a separate zone a body of a relatively heavy liquid oil at cracking temperature, utilizing the heat of vaporous cracked products from said heating zone to maintain said liquid body of oil in said second zone at said cracking temperature, separating and withdrawing cracked vaporous products from said zones, fractionally condensing them to form a distillate product suitable as charging stock for said heating zone, and passing said distillate product in liquid form directly to said heated zone.

23. The process of converting hydrocarbon oil into lower boiling gasoline-like products which comprises passing a stream of charging stock consisting substantially entirely of a normally liquid distillate oil heavier than the desired gasoline-like products through a heated zone wherein it is subjected to cracking in the vapor phase for the production of gasoline-like products, maintaining in a separate zone a body of a relatively heavy liquid oil at cracking temperature, utilizing the heat of vaporous cracked products from said heating zone to maintain said liquid body of oil in said second zone at said cracking temperature, and withdrawing cracked vaporous products from said zones, fractionally condensing them to form a distillate product suitable as charging stock for said heating zone, passing said distillate product in liquid form directly to said heated zone, substantially continuously supplying additional heavy oil to said oil body in the second zone, and substantially continuously withdrawing liquid residual products from said second zone.

24. The process of converting hydrocarbon oil into lower boiling gasoline-like products which comprises passing a stream of charging stock consisting substantially entirely of a normally liquid distillate oil heavier than the desired gasoline-like products through a heated zone wherein it is subjected to cracking in the vapor phase for the production of gasoline-like products, maintaining in a separate zone a body of a relatively heavy liquid oil at cracking temperature, passing hot vaporous cracked products from said heated zone in contact with said liquid body of oil in said second zone to maintain said oil body at said cracking temperature, withdrawing cracked vaporous products from the said separate zone and fractionally condensing them, passing resulting condensate of said vapors in liquid form directly to said heated zone for cracking in the vapor phase, substantially continuously passing fresh heavy liquid oil in indirect heat exchange relation with hot cracked products formed in the process and thereafter passing the preheated fresh oil to said second zone and adding it to the said oil body therein, and substantially continuously withdrawing liquid residual products from said second zone.

25. The process of converting hydrocarbon oil into lower boiling gasoline-like products which comprises passing a stream of charging stock consisting substantially entirely of a normally liquid distillate oil heavier than the desired gasoline-like products through a heated zone wherein it is subjected to cracking in the vapor phase for the production of gasoline-like products, maintaining in a separate zone a body of a relatively heavy liquid oil at cracking temperature, passing hot vaporous cracked products from said heated zone in contact with said liquid body of oil in said second zone to maintain said oil body at said cracking temperature, withdrawing cracked vaporous products from the said separate zone and fractionally condensing them, passing resulting condensate of said vapors in liquid form directly to said heated zone for cracking in the vapor phase, substantially continuously passing fresh heavy liquid oil in indirect heat exchange with hot vaporous products formed in the process, thereafter passing the preheated fresh oil to said second zone and adding it to said body, and substantially continuously withdrawing liquid residual products from said second zone.

26. The improvement in the art of converting hydrocarbon oils into gasoline-like products which comprises passing a confined stream of charging stock consisting substantially entirely of a normally liquid distillate hydrocarbon oil heavier than the desired gasoline-like products once-through an elongated heated zone wherein it is subjected to cracking under superatmospheric pressure for the production of gasoline-like products, passing the stream of hot cracked products from said zone into an externally unheated distilling zone, separating vapors in said distilling zone and passing them to a fractionating zone, continuously passing relatively cool feed stock in indirect heat exchange relation with hot products from said distilling zone, and thereafter discharging the preheated feed stock into direct contact with the stream of hot cracked products entering the said distilling zone whereby crackable constituents are volatilized and said feed stock is raised to a cracking temperature solely by the heat of said stream of hot cracked products, passing said volatilized portions from the said distilling zone to said fractionating zone and therein condensing such crackable constituents, withdrawing such condensate substantially free from admixture with residual cracked products and unvolatilized feed stock and passing the said condensate in liquid form directly to said cracking zone as charging stock therefor, collecting unvaporized residual products in said distilling zone in a body and maintaining said body of residual products at a cracking temperature of at least 700° F. by the heat of the said stream of cracked products discharged from said cracking zone into said distilling zone, and withdrawing residual products from said distilling

zone and avoiding the passage of any of said residual products to the said cracking zone.

27. The method of converting hydrocarbon oil into gasoline-like products which comprises flowing a stream of charging stock consisting substantially entirely of a normally liquid distillate oil heavier than the desired gasoline-like products once-through an elongated passageway and heating the oil during its flow therethrough to effect its cracking in the vapor phase under superatmospheric pressure for the production of gasoline-like products, discharging the stream of cracked products into a distilling zone, separating vapors in said distilling zone and passing them to a fractionating zone, continuously passing relatively cool feed stock in indirect heat exchange relation with products from said cracking operation, discharging the preheated feed stock into direct contact with the stream of hot cracked products entering the said distilling zone to volatilize crackable constituents, passing volatilized products from the distilling zone to the said fractionating zone and therein condensing such crackable constituents, withdrawing such condensate substantially free from admixture with residual cracked products and unvolatilized feed stock and passing the said condensate in liquid form directly to said cracking zone as charging stock therefor, collecting unvaporized residual products in said distilling zone in a body and maintaining said body at a cracking temperature of at least 700° F. by the heat of the said stream of cracked products discharged from said cracking zone into said distilling zone, and avoiding passing any unvolatilized residual products formed in the process to said cracking zone.

28. The improvement in the art of pyrolytic conversion of hydrocarbons into gasoline-like products which comprises passing a charging stock consisting substantially entirely of a normally liquid distillate oil heavier than the desired gasoline-like products once-through an elongated heated passageway and subjecting it to cracking during its flow therethrough for the production of gasoline-like products, discharging the stream of hot cracked products from said cracking zone into an externally unheated distilling zone, separating vapors in said distilling zone and passing them to a fractionating zone, continuously passing relatively cool feed stock in indirect heat exchange relation with the said separated vapors and thereafter discharging the preheated feed stock into direct contact with the said stream of cracked products entering the said distilling zone whereby crackable constituents are volatilized and said feed stock is raised to a cracking temperature solely by the heat of said stream of hot cracked products, passing said volatilized portions from the said distilling zone to said fractionating zone and therein condensing such crackable constituents, withdrawing such condensate substantially free from admixture with residual cracked products and unvolatilized feed stock and passing the said condensate directly to said cracking zone as charging stock therefor, collecting unvaporized residual products in said distilling zone in a body and maintaining said body of residual products at a cracking temperature of at least 700° F. by the heat of the said stream of cracked products discharged from said cracking zone into said distilling zone, and avoiding the passage of any of said residual products to said cracking passageway.

29. The improvement in the art of converting hydrocarbon oils into gasoline-like products which comprises passing a charging stock consisting substantially entirely of a normally liquid distillate oil heavier than the desired gasoline-like products once-through an elongated heated passageway and subjecting it to cracking during its passage therethrough for the production of gasoline-like products, discharging the stream of hot cracked products from said cracking zone into an externally unheated distilling zone, separating vapors in said distilling zone and passing them to a fractionating zone, continuously passing relatively cool feed stock in indirect heat exchange relation with vapors in said fractionating zone and thereafter discharging the preheated feed stock into direct contact with the said stream of hot cracked products entering the said distilling zone whereby crackable constituents are volatilized and said feed stock is raised to a cracking temperature solely by the heat of said stream of hot cracked products, passing volatilized portions from the distilling zone to said fractionating zone and therein condensing such crackable constituents, withdrawing such condensate substantially free from admixture with residual cracked products and unvolatilized feed stock and passing it directly to the said cracking zone as charging stock therefor, collecting unvaporized residual products in said distilling zone in a body and maintaining said body of residual products at a cracking temperature of at least 700° F. by the heat of the said stream of cracked products discharged from said cracking zone into said distilling zone, and avoiding the passage of any of said residual products to the said cracking zone.

30. The improvement in the art of converting hydrocarbon oils into gasoline-like products which comprises passing a charging stock consisting substantially entirely of a normally liquid distillate oil heavier than the desired gasoline-like products once-through an elongated heated passageway and subjecting it to cracking during its passage therethrough for the production of gasoline-like products, discharging the stream of hot cracked products from said cracking zone into an externally unheated distilling zone, separating vapors in said distilling zone and passing them to a fractionating zone, continuously passing relatively cool feed stock in indirect heat exchange relation with vapors flowing from said distilling zone to said fractionating zone and thereafter discharging the preheated feed stock into direct contact with the said stream of hot cracked products entering the said distilling zone whereby crackable constituents are volatilized and said feed stock is raised to a cracking temperature solely by the heat of said stream of hot cracked products, passing said volatilized portions from the said distilling zone to said fractionating zone and therein condensing such crackable constituents, withdrawing such condensate substantially free from admixture with residual cracked products and unvolatilized feed stock and passing it in liquid form directly to said cracking passageway as charging stock therefor, collecting unvaporized residual products in said distilling zone in a body, maintaining said body of residual products at a cracking temperature of at least 700° F. by the heat of the said stream of cracked products discharged from said cracking zone into said distilling zone, thereby effecting decomposition of said residues, and avoiding the passage of any of said residual products to the said cracking zone.

RENÉ DE M. TAVEAU.

CERTIFICATE OF CORRECTION.

Patent No. 1,936,735. November 28, 1933.

RENE de M. TAVEAU.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, line 82, claim 16, before "to" insert the word oil; and line 145-146, claim 20, for "frictionally" read fractionally; page 6, line 3, claim 21, for "converging" read converting; and line 128, claim 26, after "zone" strike out the comma; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 30th day of January, A. D. 1934.

F. M. Hopkins

(Seal) Acting Commissioner of Patents.

Doherty Exhibit #7.

Claims in Suit

Offered under Rule 109 No Estoppel	Amended Claims Held Estopped	Heating Step M = Mixed V = Vapor Phase
(50)	1	M
(51)	2*	M
(52)	3	M or V
	4*	M or V
(53)	5	V
	8	V
	12	M
	13	M
	45*	M
(54)	46	M or V
(55)	47*	M
(56)	48*	M
	No Estoppel Offered under Rule 109	
	50	M
	51	M or V
	52	M or V
	53	V
	54	V
	55	V
	56	V

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* Not rejected on lack of disclosure. Other claims rejected on lack of disclosure of vapor phase cracking.

376 Endorsed: U. S. Patent Office Board of Appeals Oct 1-1936 Mailed

Appeal No. 14,817 Paper No. 33
Decision.

Appeal No. 14,817 REH

In the United States Patent Office

Before the Board of Appeals

Ex parte Henry L. Doherty

Application for Patent filed January 19, 1929, Serial No. 333,650, a division of application No. 361,030, filed February 24, 1920. Process of Distilling Oils.

Mr. Edmund G. Borden for applicant.

Request for Ruling on Claim 15.

In appellant's communication of September 15, 1936, we are asked to specifically rule upon claim 15 of the claims listed in the examiner's statement of September 6, 1935.

Examination of our decision rendered March 13, 1936, discloses no specific reference to this claim. The notes from which our decision was prepared have now been destroyed so no explanation as to our failure to pass on the claim can be given. However, it appears that appellant is entitled to have his request granted.

Claim 15 was rejected by the examiner along with claims 16 and 17 on a patent to Biddison, 1,345,740, in view of a patent to von Groeling. In our decision the position
377 of the examiner with respect to claims 16 and 17
was reversed. Claim 15, however, is slightly broader than claims 16 and 17 in that it omits reference to the treatment of the vapors separated from the carbon and tar in a reflux condenser in heat exchange with charging oil. Claim 15 merely involves the separation of carbon and

tarry matter from a stock which has previously been heated to a cracking temperature and passing the clarified oil to the supply chamber, the vapors being removed and collected and fresh oil being added to the supply.

It seems to us that claim 15 does not patentably define over Biddison et al. In this patent a charging oil is taken from a source of supply, such as tank 8, and pumped, after preheating, through a cracking coil 2. On leaving this cracking coil, the tar and carbon are separated and the residue returned to the storage tank where gas and vapors are removed. From tank 8 the devaporized oil passes to tank 18 where fresh charging stock may be introduced. We are unable to see that the procedure set forth in claim 15 in any way patentably defines from that inherent in the operation of the Biddison et al construction.

Our former decision is supplemented to the extent that the examiner's action as to claim 15 is affirmed.

In the request for a ruling on claim 15, it is stated that the attorney has no objection to having the time for response date from the decision of the Board of Appeals of May 1, 1936. In view of this statement, the date for response will be set to expire six months from May
378 1, 1936.

BOARD OF APPEALS

EUGENE LANDERS
Examiner-in-Chief

P. P PIERCE
Examiner-in-Chief

F. EDINBERG
Examiner-in-Chief

October 1, 1936

379 Endorsed: U. S. Patent Office Board of Appeals Jun 1-1931 Mailed

Appeal No. 798, 799, 800 Paper No. 45

Decision
REH

Appeals Nos. 798, 799 and 800.

Hearing:
April 17, 1931

In the United States Patent Office

Before the Board of Appeals

Isom v. Taveau v. Brandt v. Doherty.

Patent Interference No. 58,781 between the applications of Edward W. Isom filed June 10, 1927, Serial No. 197,781 a division of Serial No. 584,711, filed Aug. 28, 1922; Rene' de M. Taveau filed Mar. 30, 1922, Serial No. 547,945; David G. Brandt filed Jan. 14, 1928, Serial No. 532,953, renewal of application filed Jan. 31, 1922; and Henry L. Doherty filed Jan. 19, 1929, Serial No. 333,650 a division of Serial No. 361,030 filed Feb. 24, 1920. Distillation of Oil.

Messrs. Rector, Hibben, Davis & Macauley and Messrs. Pennie, Davis, Marvin & Edmonds for Isom.
Mr. R. J. Dearborn for Taveau.
Mr. Edmund G. Borden for Brandt.
Mr. Edmund G. Borden for Doherty.

This interference involves four parties, three of whom have appealed from the decision of the Examiner of Interferences rendered on motions to dissolve and to add counts. The matters presented for our consideration are well summed up in the brief for the party Taveau as follows:

"1. Doherty's right to make count 1 and proposed counts 2 to 9, 13, 14 and 15.

380 2. Brandt's right to make proposed counts 2 to 9, 13, 14 and 15.

3. Taveau's right to make 2, 3, 14 and 15.

4. The patentability of count 1 and proposed count 3''.

The alleged invention involved relates to the cracking of oil and the single count of the interference is an apparatus count. All of the parties show somewhat similar apparatus and the Examiner of Interferences has held that all except Doherty are entitled to make the count if certain functional limitations which somewhat involve the process disclosed are disregarded. However, disregarding these functional limitations the examiner holds that the count is unpatentable over the patent to Coast in view of Greenstreet or Rosenbaum which show it old to return reflux condensate directly to the pipe coil of the apparatus, the count being construed to require such a direct return. The examiner holds that Doherty has no right to make the claim because he discloses no return of reflux condensate to the pipe coil, it being the examiner's opinion that no reflux condensate will be returned due to its revaporization in the cracking chamber.

Proposed count 3 has also been held unpatentable over the same references. It may be here noted, however, that claim 3 is a process claim.

The Coast patent shows oil treating apparatus embodying a pipe coil still from which heated oil and vapor is discharged into a mass or bulk still containing a con-
381 siderable volume of oil to be cracked. After the
process is in operation the heat of the oil and vapor so discharged is mainly relied on to furnish the necessary temperature for cracking the oil in the bulk still. Oil in passing through the heating coils is raised to a temperature of about 900° F and is depended on to produce a temperature in the main still of about 750° F. Vapors given off from the still proper are subjected to reflux condensation and eventual recovery in an ordinary coil, the reflux condensate being returned to the still for further treatment. It is the examiner's position that it would not amount to invention broadly to return this condensate to the coil element of the system rather than to the body of oil in the main still. We consider his position sound especially when we take into consideration that it is an old expedient to return such condensate to various points in

the system as shown, for instance, by the references above referred to. We find no error in the examiner's holding with respect to the count of the interference.

As to proposed count 3 also held unpatentable we are of
the opinion that the Coast patent is not properly anticipa-
tive. As above noted the proposed count is drawn to a
process and we deem it well settled that a process is not
anticipated by apparatus which is merely capable of carry-
ing it out. It is only where the process under considera-
tion involves the inherent and necessary operation of old
apparatus that it is properly anticipated. More-
382 over, proposed count 3 does not greatly differ from
other proposed counts held to be allowable. See
proposed count 14, for instance.

In considering count 3 and proposed counts 2, 14 and 15 as well, the examiner has construed the counts as drawn to liquid phase cracking. His holding in this respect is based on a definition of liquid and vapor phase cracking which he gives in his decision as follows:

"In explanation of the above and the proposed counts to be treated it is stated here that cracking in the vapor phase is taken as meaning that vapors only are sent through the cracking unit. That, furthermore, if liquid be present, the cracking is in the liquid phase although vapors are also present, for vapors are invariably produced by liquid phase cracking".

All of the parties take exception to the quoted definition of liquid and vapor phase cracking.

While we are not prepared from the data before us to
define the two types of cracking, it seems to us that it is
more a matter of temperature and pressure than of the
presence or absence of liquid. The authorities to which
our attention has been called seem to bear this out. Bur-
rell, for instance, in the National Petroleum News for Feb-
ruary 12, 1930 refers to cracking between 750 and 1000°
F as liquid phase and between 1050 and 1150° as vapor
phase. Other authorities referred to seem to indicate that
the ranges here given are not invariable and that cracking
in vapor phase may take place at somewhat lower
383 temperatures, presumably depending somewhat on
the pressure conditions. It is our view that the
counts now under consideration cannot properly be con-
strued as drawn to liquid phase cracking. The counts them-

selves in our opinion clearly call for vapor phase cracking. Thus count 2 requires "vaporizing portions of said oil in said zone and heating the vapors and unvaporized oil to a high temperature sufficient to crack the same". Count 3 calls for "heating the resulting vapors to a temperature sufficient to crack the same".

Count 14 specifies "a cracking zone in which the oil is heated to a temperature sufficient to vaporize and crack portions thereof in the vapor phase".

Count 15 contains a similar limitation.

Proposed counts 2, 14 and 15 have been held patentable by the Examiner of Interferences but he holds that the party Taveau is not entitled to make them nor to make proposed count 3 which he holds unpatentable. In our opinion these counts are clearly readable on the Taveau disclosure.

In considering count 2 the examiner holds that Taveau does not disclose heating vapors and unvaporized oil to a high temperature sufficient to crack the same. In our opinion the coil 45 has this function.

With respect to count 3 the Examiner holds that Taveau does not disclose "passing a mixture of heavy reflux condensate and other oil to be cracked in a stream through a heating zone". As we view the matter it is not necessary that the stream be wholly liquid or even that 384
it contain any liquid in the final stages. Clearly reflux condensate is supplied by way of the pipes 75 and 77 and other oil may, if desired, and within Taveau's disclosure, be supplied by way of pipe 47 to the preheater 52 whence it is fed through the cracking coil 45.

As to claims 14 and 15 the examiner holds that a stream of oil containing reflux condensate derived from the process is not introduced into the cracking zone and that a distillate oil is not subjected to cracking conditions, etc.

Both of these claims require that cracking take place in vapor phase, the examiner's holding to the contrary notwithstanding, and in our opinion Taveau clearly discloses such a form of cracking. In his specification he states that the temperature in coil 45 may range from 500 to 600° C. This corresponds roughly to the temperature specified by Burrell in the article above referred to. Taveau's specification, furthermore, leaves no doubt as to his intentions with respect to vapor phase cracking.

While we are considering this group of claims it may be well to pass on both Doherty's and Brandt's right to make them. As to Doherty the examiner holds that he is not entitled to make them because of his failure to disclose the return of reflux condensate to the cracking coil or
385 vapor phase cracking zone. While we are inclined
to agree with the examiner as to this point we are also of the opinion that he is not entitled to make them because of his failure to clearly disclose vapor phase cracking which in our opinion the claims require. We are not unmindful of the fact that these claims are proposed by Doherty and that certain of them, if not all, originated in his divisional application here involved.

After carefully considering Doherty's application as a whole we are constrained to agree with the view adopted by the examiner—that he did not have vapor phase cracking in mind. After carefully reading the specification it is our opinion that what Doherty had in mind was liquid phase cracking in a bulk still at comparatively low temperature in order to restrict the range of the resultant products to that most desirable for motor fuels, and incidentally to prevent formation of coke and other undesired substances commonly incident to cracking in a direct heated still.

There are some passages in Doherty's specification such as referred to by the examiner which taken by themselves are ambiguous but which might indicate that vapor phase cracking was contemplated. These passages, however, when construed in the light of the context, seem to leave no doubt that Doherty had no such operation in mind when the original application was filed. The passages in question are not inconsistent with liquid phase cracking
386 and in our view the temperature ranges specified,
while they do not necessarily preclude vapor phase cracking if proper stock and pressure conditions are used, indicate that only so much heat was to be supplied to the oil in the pipe coil as would provide for the desired low temperature cracking of the more easily crackable stock in the still proper.

In arguing his right to make these claims Brandt points out that gas oil is a possible material to be used in the pipe still when a fuel oil is to be cracked and wishes us to read into his disclosure that when such oil is used the maximum specified temperature will also be used.

Taking into consideration the general nature and objects of the invention it is our opinion that when a combination of this kind is present the teachings of the application would lead one to provide only so much heat in the pipe coil as would provide the comparatively low heat required for cracking the fuel oil. It is our view that Brandt is not entitled to make claims 2, 3, 14 and 15.

Brandt's disclosure with respect to these claims leaves no doubt that his intention was to supply only sufficient heat to the pipe still to effect low temperature conversion in the still proper when oil and vapors from the pipe still were discharged thereto. The specification as originally filed emphasizes the fact that cracking is not to take place in the pipe still and it is our view that such cracking
387 is not necessarily inherent as now urged. The examiner's holding as to Brandt is considered without error, not only with respect to claims 2, 3, 14 and 15 but with respect to claims 4 to 9 and 13 as well.

From what we have said in discussing Doherty's application in connection with proposed counts 2, 3, 14 and 15 it follows that he is not entitled to make proposed counts 4 to 9 and 13. As pointed out by the examiner, all of these counts are limited to vapor phase cracking and there is no clear disclosure in Doherty's application of such cracking. We deem it unnecessary to discuss the counts of this group in detail as the examiner has pointed out with respect to each count some feature which is lacking in the Doherty disclosure.

The examiner's holding with respect to the patentability of count 3 and with respect to the appellant Taveau's right to make proposed counts 2, 3, 14 and 15 is reversed. His holding with respect to the patentability of the present count and with respect to both Doherty's and Brandt's right to make counts 2 to 9, 13, 14 and 15 is affirmed.

BOARD OF APPEALS.

M J MOORE
Assistant Commissioner
EUGENE LANDERS
Examiner-in-Chief
P. P. PIERCE
Examiner-in-Chief

June 1, 1931

388 Endorsed: United States Court of Appeals for the District of Columbia Filed Nov 30 1938 Joseph W. Stewart Clerk

In the United States Court of Appeals for the District of Columbia

Appeal No. 7291.

POWER PATENTS COMPANY, *Plaintiff-Appellant*

vs.

CONWAY P. COE, COMMISSIONER OF PATENTS, *Defendant-Appellee*

Joint Designation for Printing Record

Counsel for the respective parties hereby jointly designate the portions of the record to be printed, as follows:

The record is to be printed as filed, *except:*

1. Out of Plaintiff's Exhibit No. 1, comprising record pages 63 to 320, inclusive, *print only:*

(a) The original application papers, comprising record pages 63 to 105, inclusive.

(b) The file jacket and three sheets of drawing, comprising record pages 317 to 320, inclusive.

(c) Patent Office letter, Paper No. 3, dated June 19, 1929, and appearing on record page 110.

(d) Amendment marked Paper No. 4, and comprising record pages 111 to 113, inclusive.

(e) Amendment marked Paper No. 8, filed June 13, 1932, and comprising record pages 125 to 134, inclusive.

(f) Page 1 of amendment marked Paper No. 10, filed May 25, 1933, and appearing on record page 140.

(g) Amendment marked Paper No. 12, filed April 5, 1934, and comprising record pages 150 to 165, inclusive.

389 (h) Patent Office letter marked Paper No. 23, dated February 19, 1935, and comprising record pages 201 to 203, inclusive.

(i) Amendment marked Paper No. 24, filed June 1, 1935, and comprising record pages 204 to 209, inclusive.

(j) Appeal to the Board of Appeals filed June 1, 1935, and comprising record pages 210 and 211.

(k) Examiner's Statement marked Paper No. 26, dated September 6, 1935, and comprising record pages 212 to 232, inclusive.

(1) Decision of the Board of Appeals dated March 13, 1936, and comprising record pages 278 to 288, inclusive.

(m) Request for Reconsideration, dated April 18, 1936, and comprising record pages 289 to 303, inclusive.

(n) Decision of the Board of Appeals dated May 1, 1936, and comprising record pages 304 to 308, inclusive.

Note: In printing item (a) above, comprising the application papers, if the printing is to be done by setting type, all pen and ink lines, insertions, and alterations are to be omitted, the printed page to show only the typewritten matter. If, on the other hand, printing is to be done by photolithographing or the like, then item (a) may be reproduced as it now appears, including the pen and ink insertions.

2. In Defendant's Exhibit No. 1, comprising record pages 335 to 387, inclusive, *print only:*

(o) Decision of the Board of Appeals dated October 1, 1936, and comprising record pages 376 to 378, inclusive. 390

(p) Decision of the Board of Appeals dated June 1, 1931, relating to Interference No. 58,781, and comprising record pages 379 to 387, inclusive.

J. HANSON BOYDEN
Counsel for Power Patents Company

Washington, D. C.
November 30, 1938.

R. F. WHITEHEAD
Counsel for the Commissioner of Patents.

Washington, D. C.
November 30, 1938.

Endorsed on Cover: No. 7291. Power Patents Company, Appellant, vs. Conway P. Coe, Commissioner of Patents. United States Court of Appeals for the District of Columbia Filed Nov 25 1938 Joseph W. Stewart, Clerk.